7-19-96

Taylor Energy Company

Mississippi Canyon 20 Operating Manual

TAYLOR
ENERGY COMPANY

PATRICK F. TAYLOR
Chairman and CEO

June 11, 1996

BDM Oklahoma, Inc.
Attn: Todd Martinez
PO Box 2565
220 NW Virginia Ave.
Bartlesville, OK 74005

RE: Demonstration of a Safety and Environmental Management Program for Offshore Oil and Gas Producing Operations on the Outer Continental Shelf
Subcontract G4S50125

First Annual Technical Progress Report

Dear Mr. Todd Martinez:

The attached First Annual Technical Progress Report summarizes the work performed and the technical results achieved during the first contract year commencing on May 1, 1995 and ending on April 30, 1996.

Also enclosed are copies of work products completed during the fourth quarterly period as follows:

- Process Hazards Analysis Report, MC 20 Platform
- Operating Manual, MC 20 Platform
- Safety Handbook
- Case Study Technology Transfer Report

If there are any questions or clarifications that I can help with, please call me at (504) 581-5491.

Sincerely,

Jay T. Hoyle
FOR
Gerald Von Antz
Safety Manager

cc: TEC - HLB, TA, BF
Paragon - JTH

Enclosures

Demonstration of a Safety and Environmental Management Program for Offshore Oil and Gas Producing Operations on the Outer Continental Shelf

First Annual Technical Progress Report

Subcontract G4S50125

This Annual Technical Progress Report summarizes the work performed and the technical results achieved during the first contract year commencing on May 1, 1995, and ending on April 30, 1996.

1. SEMP SYSTEM DEVELOPMENT

Four manuals were developed to define the SEMP plan; these manuals apply company-wide and address matters that are not site-specific.

Taylor's *Safety and Environmental Management Program (SEMP) Manual* presents the requirements and responsibilties for implementing each element of Taylor's SEMP. This manual was completed and submitted to BDM on September 14, 1995.

Taylor's *Safety Manual* presents the safety policies, programs, and practices that are in effect on Taylor's facilities. This manual was completed and submitted to BDM on January 24, 1996.

Taylor's *Safe Drilling and Workover Practices Manual* establishes the requirements for safe drilling and workover operations at Taylor's facilities. This manual was completed and submitted to BDM on January 24, 1996.

Taylor's *Safety Handbook* briefly describes the safety policies and safe work practices that are in effect at Taylor's facilities; each employee is to receive a copy of this handbook. This handbook was completed May 9, 1996, and is being printed for distribution at this time.

2. PROCESS SAFETY INFORMATION

The first site-specific task undertaken on this project was the compilation of process safety information for the facilities. The following up-to-date "As-Built" drawings were prepared for each of the seven platforms. Copies of these drawings are maintained at the facility and at Taylor's New Orleans office. Copies of the drawings were submitted to BDM on January 24, 1996.

- Simplified Process and Instrument Diagrams
- Life Saving and Emergency Equipment Location Drawings
- Electrical Area Classification Drawings

3. HAZARDS ANALYSIS

The hazards analysis has been completed for one facility, the MC 20A platform. The report and documentation were finalized April 18, 1996.

The hazards analysis for SMI 69B and the SMI 73 field is in progress. The three platforms in this field, SMI 69B, SMI 72C, and SMI 73A, are being analyzed together because they operate in connection with each other. The analyses for these three platforms is projected to be completed by July 1.

The hazards analyses for the remaining three platforms will be performed following the analysis for the SMI 73 field; the final analysis is projected to be completed in August.

4. WRITTEN OPERATING PROCEDURES

The format and content of the written operating procedures manuals has been established. The manual for MC 20 facility is complete and has been implemented. Interviews with the facilities operators have been conducted and preliminary drafts are underway for the remaining six facilities. Progess on the operating procedures manual for each platform is as follows:

• MC 20	Final version (Rev. 0)	Complete and issued April 12, 1996
• SMI 69B	First draft (Rev. A)	90% complete
• SMI 72C	First draft (Rev. A)	75% complete
• SMI 73A	First draft (Rev. A)	75% complete
• SMI 27	First draft (Rev. A)	75% complete
• VER 191	First draft (Rev. A)	75% complete
• MAT 665	First draft (Rev. A)	50% complete

5. IMPLEMENTING AND MONITORING THE SEMP PLAN

Training has been ongoing, covering the topics outlined in the proposal. We have completed all initial training with the exception of operating procedures, mechanical integrity and simultaneous operations. The SEMP Implementation Plan has been distributed and implementation of the plan is considered complete.

6. AUDITING

No action has been taken during the first year as to verification and testing of the SEMP program. Costs to date have been compiled as follows and are presented in the spreadsheet attached to this report.

- **Cost for Developing the SEMP Plan**
  Program Manuals
  Process Safety Information
  Hazards Analyses
  Operating Procedures
  Mechanical Integrity Procedures

- **Cost for Implementing and Monitoring the SEMP Plan**

- **Cost Associated with Maintenance of the Project**
  Auditing and Reporting to MMS/DOE
  Technology Transfer
  General

7. TECHNOLOGY TRANSFER

Technology transfer activities during the first project year included the following:

- May 24, 1995: Taylor's Gerald Von Antz and Paragon's Ken Arnold spoke at the IPAA Offshore Committee Midyear Meeting in Boca Raton, Florida. The presentations addressed the scope of the Taylor SEMP Case Study Project and the history of offshore safety incidents and subsequent regulations.

- July 20, 1995: Taylor's Hal Bettis addressed the Offshore Operators Committee meeting in Houston, Texas. The presentation was an overview of the scope of the Taylor SEMP Case Study Project.

- September 21 and 26, 1996: Gerald Von Antz and Paragon's Jay Hoyle participated as session leaders at API's RP75 Focus Training Workshops. Von Antz led sessions addressing Operating Procedures and Hoyle led sessions addressing Hazards Analyses.

- October 18, 1995: Gerald Von Antz was a panel member at the LAGCOE meeting held in Lafayette, Louisiana. The panel discussed SEMP implementation.

- December 14, 1995: Paragon's Rick Bresler and Gerald Von Antz spoke at the MMS 15th Information Transfer Meeting (OCS Industry Issues Session) held in New Orleans, Louisiana. The presentation reviewed the development to date of the SEMP plan for the Taylor SEMP Case Study Project.

- January 30, 1996: Rick Bresler and Gerald Von Antz presented a paper titled, "Preliminary Results of a Safety and Environmental Management Program (SEMP) Case Study Sponsored by the DOE and MMS" at the Energy Week Conference and Exhibition held in Houston, Texas.
  Additionally, this paper was published in the February 1996 edition of the *Ameican Oil and Gas Reporter* as an article titled, "SEMP Adoption Contributes To Workplace Accident Prevention."

- May 9, 1996: Rick Bresler presented a paper titled, "Operating Procedures - Preliminary Results of a Safety and Environmental Management Program (SEMP) Case Study Sponsored By the DOE and MMS" at the Offshore Technology Conference in Houston, Texas. The paper is authored by Bresler and Gerald Von Antz and describes the design and development of written operating procedures.

- June 5, 1996: Hal Bettis presented a status report of the SEMP Case Study project at the IPAA Offshore Operators Committee general membership meeting in Houston, Texas. All previously submitted manuals and case study materials were available for distribution.

Upcoming techonlogy transfer activities include:

- June 12, 1996: Jay Hoyle will present a paper titled, "Hazards Analysis: Preliminary Results of a Safety and Environmental Management Program (SEMP) Case Study Sponsored by the DOE and MMS" at the SPE Third International Conference on Health, Safety & Environment in Oil & Gas Exploration & Production to be held in New Orleans, Louisiana. The paper is authored by Hoyle and Gerald Von Antz and describes the hazards analysis guidelines of Taylor's SEMP program and the methodology and results of the analysis of one facility.

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1. Process Descriptions

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REVIEWS:

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1.1 Downhole System and Wellheads

Casing

Casing has been installed in each wellbore to prevent the following:

- Communication between reservoirs
- Contamination of fresh-water reservoirs
- Hole cave-in

Casing head

A casing head to which the tubing head assembly is connected is installed at the top of the casing. This equipment connects the casing and the tubing string at the top of the well.

Tubing strings

Inside the casing, a tubing string is placed to route produced fluids from the reservoir to the surface.

Some wells are completed as single completions; others are dual completions. A Surface Controlled Subsurface Safety Valve (SCSSV) is provided in each production tubing string to allow for downhole shut-in of the wells.

Wellheads

Wellheads (Christmas tree) that are installed on top of the casing provide valving to control or shut off the flow of fluids from the reservoir and the tubing to the surface production equipment.

MAWP

The wellheads are rated for a maximum allowable working pressure (MAWP) of 5000 psig.

Fluid flow path

Produced fluids pass through the lower master valve, Surface Safety Valve SSV-1, wing Surface Safety Valve SSV-2, and a choke (internals have been removed) to the well flow line.

Both SSV-1 and SSV-2 are equipped with pneumatic actuators.

1.2 Inlet Gas, Oil, and Water

Overview

A mixture of gas, oil, and water flows from each wellhead to the manifold, which routes the fluids to the separators, from which gas flows to the compressor and to the glycol system, oil flows to the oil handling system, and water flows to the water treating system.

Equipment

The inlet gas, oil, and water system includes the following equipment items, each of which is discussed below:

- Inlet manifold
- Test separator
- High-pressure separator
- Intermediate-pressure separator
- Low-pressure separator
- Gas compressor
- Fuel gas scrubber

Inlet manifold

The inlet manifold, which receives flow from each wellhead, is a skid-mounted, 28-wellstream, 4-header unit that routes wellstream fluids to either the test separator, the low-pressure separator, the intermediate-pressure separator, or the high-pressure separator.

Test separator

The test separator, which is designed to process 20 MMSCFD of gas and 1000 BPD of liquid while operating at 1000 psig, receives wellstream fluids from an individual well via the inlet manifold's test header. All gas, oil, and produced water that is discharged from the test separator is distributed as follows:

- High-pressure gas is routed to the filter separator; intermediate-pressure gas is routed to the gas compressor's second-stage suction; and low-pressure gas is routed to the gas compressor's first stage or to the low-pressure separator.

- Oil can be routed to either the intermediate-pressure separator, the low-pressure separator, or the oil handling system's emulsion treater.

- Produced water is sent to the water treating system's water skimmer.

Continued on next page

1.2 Inlet Gas, Oil, and Water (continued)

Test separator (continued)

The test separator is currently operating at low pressure in parallel with the intermediate-pressure separator and the low-pressure separator.

High-pressure separator

The high-pressure separator, which is currently out of service, is designed to process 60 MMSCFD of gas and 10,000 BPD of liquid while operating at 1000 psig and 100°F. When in service, the high-pressure separator receives wellstream fluids from the inlet manifold's high-pressure header. When the high-pressure separator is in service, separated gas and liquids are discharged as follows:

- Gas is routed to the filter separator.
- Liquids can be routed to the intermediate-pressure separator, the low-pressure separator, or the oil handling system's emulsion treater.

Intermediate-pressure separator

The intermediate-pressure separator, which is designed to process 5 MMSCFD of gas and 10,000 BPD of liquid while operating at 350 to 400 psig, receives wellstream fluids from the inlet manifold's intermediate-pressure header. The intermediate-pressure separator can also receive liquids from the high-pressure separator or the test separator. Gas and liquids are discharged from the intermediate-pressure separator as follows:

- Gas can be routed to the filter separator, the gas compressor's first- or second-stage suction, and the fuel gas scrubber.

- Produced water is routed to the skimmer.

- Oil production is normally routed to the emulsion treader, but it can be routed to the low-pressure separator if the intermediate-pressure separator is operating at a higher pressure than the low-pressure separator.

The intermediate-pressure separator is currently operating in parallel with the test separator and the low-pressure separator. The intermediate-pressure separator can also be used as a backup test separator or low-pressure separator.

Continued on next page

1.2 Inlet Gas, Oil, and Water (continued)

Low-pressure separator

The low-pressure separator, which is designed to process 1.5 MMSCFD of gas and 10,000 BPD of liquid while operating at 140 to 150 psig, receives wellstream from the inlet manifold's low-pressure header. The low-pressure separator can also receive liquids from the test separator, the high-pressure separator, the intermediate-pressure separator, and the filter separator. Gas, oil and water are routed from the low-pressure separator as follows:

- Most of the gas is routed to the gas compressor's first-stage suction. A small portion of the gas is routed to the fuel gas scrubber.
- Oil is routed to the oil handling system's emulsion treater.
- Water is sent to the water treating system's water skimmer.

The low-pressure separator is currently operating in parallel with the test separator and the intermediate-pressure separator.

If necessary, all feed streams to the low-pressure separator can be manually diverted to the emulsion treater.

Gas compressor

The gas compressor is a naturally-aspirated, gas-engine-driven reciprocating unit that receives low-pressure gas and compresses it to pipeline pressure. The compressor unit includes the following components:

- First- and second-stage suction scrubbers
- A two-section gas/air cooler
- A natural gas engine
- Two compressor stages

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1.2 Inlet Gas, Oil, and Water (continued)

Gas compressor (continued)

Gas that passes through the first-stage suction scrubber is compressed from approximately 120 psig to 400 psig. The gas then passes through the interstage section of the gas/air cooler and is combined with the gas from the intermediate-pressure separator (when this separator is operating at interstage pressure) and then routed through the second-stage suction scrubber. The gas is then compressed from about 400 psig to a maximum of 1200 psig. The compressed gas passes through the aftercooler section of the gas/air cooler to the filter separator. Liquids collected in the scrubbers are discharged to the water skimmer.

Fuel gas scrubber

The fuel gas scrubber receives gas primarily from the low-pressure separator. The gas that is discharged from the fuel gas scrubber is metered and sent to the fuel gas header. Liquids that are collected in the scrubber are discharged to the water skimmer.

If the fuel gas scrubber is not in service, start-up gas is obtained from the A4 well.

1.3 Oil Handling

Overview

In the oil handling system, liquids from the separators, the glycol system's glycol/condensate skimmer, and the wet/dry oil storage tank are treated to reach a basic sediment and water (BS&W) concentration of less than 1% (design BS&W concentration is 0.5%). The treated oil is then measured and sent to a pipeline.

Equipment

The oil handling system includes the following equipment items, each of which is discussed below:

- Emulsion treater
- Wet/dry oil storage tank
- Wet oil circulating pumps
- Lease Automatic Custody Transfer (LACT) unit
- Pipeline pumps

Emulsion treater

The emulsion treater is equipped with two 2 MMBtu/hr 18-inch forced-draft firetubes and an electrostatic precipitator. The treater is designed to process 8,000 BOPD, 1,600 BWPD and 0.3 MMSCFD of gas while operating at 20 to 30 psig.

Some gas flashes off from the oil in the treater's scrubber section. The emulsion then enters a spreader below the firetubes; any free water is removed at this point. Next, the emulsion flows upward around the firetubes and is heated to the required temperature. The emulsion then enters the treater's coalescing section, in which the emulsified water is coalesced (with the aid of the electrostatic precipitator, if necessary) and separated from the oil. Water, gas, and oil are discharged from the treater as follows:

- Water is routed to the water skimmer.
- Gas is routed to the low-pressure vent system.
- Oil is monitored by a BS&W monitor and routed to the appropriate section of the wet/dry oil storage tank.

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1.3 Oil Handling (continued)

Wet/dry oil storage tank

The wet/dry oil storage tank provides storage capacity for wet oil (greater than 1% BS&W) and dry (pipeline-quality) oil. The tank is a dual-compartment unit with a 1 psig MAWP. Dry oil is routed into the tank's dry section from the emulsion treater. Oil in the dry section is discharged to the LACT unit.

Off-spec oil from the emulsion treater, LACT unit, or water skimmer is routed to the wet section of the wet/dry oil storage tank. From the tank, the off-spec oil is pumped back to the emulsion treater for further treatment.

A natural gas blanket maintains an operating pressure of 5 to 8 inches of water in the tank.

Wet oil circulating pumps

The two wet oil circulating pumps circulate wet oil between the wet section of the wet/dry oil storage tank and the emulsion treater, as needed. Each pump is an electrically-driven, 5 hp, single-stage, vertical in-line centrifugal unit that is designed to pump 60 gpm from atmospheric pressure to 45 psig. Each pump has the capacity to handle the platform's full load (100% standby capacity).

LACT unit

The platform's LACT unit is a dual-train (100% standby) measurement system with a design capacity of 8000 BOPD per train. The unit includes the following:

- Two 10 hp electrically-driven centrifugal LACT unit charge pumps
- Two A.O. Smith meters
- Two basket strainers/air eliminators
- Two BS&W monitors
- Two divert valves
- One automatic proportional sampling system
- One bi-directional prover loop

Oil is gravity-fed from the wet/dry oil storage tank's dry section to the LACT unit's charge pumps and then pumped through a strainer/air eliminator. The BS&W content is then checked, and only pipeline-quality oil is measured - the rest is sent to the tank's wet section. Pipeline-quality oil is discharged from the LACT unit at approximately 35 psig to the pipeline pumps.

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1.3 Oil Handling (continued)

Pipeline pumps

The three 125 hp electric-motor-driven triplex pipeline pumps are mounted on a single skid. Each pump can handle 50% of platform capacity; during normal operations, two of the pumps are operating in parallel, and the third is on standby.

The pipeline pumps receive pipeline-quality oil from the LACT unit, pump it up to pipeline pressure, and deliver it to the crude oil pipeline. Each pump is designed to pump 4000 BOPD from 30 psig to a maximum discharge pressure of 1380 psig.

1-4. Glycol Dehydration

Introduction

The glycol dehydration system is designed to process 60 MMSCFD of gas at a temperature of 100°F and at pressures between 1000 and 1200 psig. Dry ("lean") Triethylene glycol (TEG) is used to remove water from the natural gas. The resulting water-saturated ("rich") glycol is then regenerated and used again.

In general, the glycol dehydration system involves two main processes, gas dehydration and glycol regeneration.

Gas dehydration

The gas dehydration process occurs as follows:

1. Gas from the test separator, high-pressure separator, and gas compressor flows through the **filter separator**, in which solids and liquids are removed. The recovered liquids are routed to the low-pressure separator.

2. Gas flows from the filter separator to the **gas/glycol contactor**, in which TEG absorbs water vapor from the gas stream. The gas now contains less than 7 lb of water per MMSCF, and the rich glycol begins the regeneration process (see "glycol regeneration" below).

3. The gas flows through the **gas/glycol heat exchanger** and into the **glycol/gas scrubber**. Entrained glycol is removed in the scrubber.

4. The gas is metered and routed to the **sales gas metering skid** and then to the **sales gas pipeline**.

Glycol regeneration

The glycol regeneration process occurs as follows:

1. Rich glycol flows from the gas/glycol contactor through the reflux cooling coil in the **glycol reboiler/surge tank**'s still column and then through the first of two **glycol/glycol heat exchangers**.

Continued on next page

1.4 Glycol Dehydration (continued)

Glycol regeneration (continued)

2. The rich glycol flows through the **glycol/condensate skimmer**, in which dissolved natural gas and entrained hydrocarbons are removed. The dissolved natural gas is either used as fuel gas for the glycol reboiler or routed to the low-pressure vent header. The entrained hydrocarbons are routed to the oil handling system's emulsion treater.

3. The rich glycol flows through the **sock filter** and the **charcoal filter**, in which entrained solid particles, hydrocarbons, and other impurities are removed.

4. The rich glycol flows through the second **glycol/glycol heat exchanger** to the glycol reboiler/surge tank's still column and drains down through the still column's packing into the reboiler section. In the reboiler, the glycol heated to 380 to 400°F, and water is boiled off. The resulting water vapor vented to the atmosphere, and the glycol is now "lean."

5. The lean glycol is routed from the glycol reboiler/surge tank's reboiler section to its surge tank section.

6. The glycol is cooled in both glycol/glycol heat exchangers and is pumped the **glycol pumps** to the gas/glycol heat exchanger and then into the gas/glycol contactor to dehydrate the incoming gas.

Glycol pump details

The two glycol pumps are 10 hp electric-motor-driven triplex plunger pumps. The pumps are designed to pump 407 gph of glycol from atmospheric pressur to 1200 psig at approximately 200°F. Each pump is designed to handle the to load (100% standby).

2. Platform Start-Up Procedure (continued)

Procedure **(continued)**

Step	Action
7. (cont'd)	• Pull the "Pull to Reset after ESD" knob for the SSVs. • Close the air supply to the "wing" SDV actuator for each well. • Bypass all PSHL indicators. • Pull the "Pull to Reset PSHL Indicator Train" knob.
8.	At the Well Control Panel, open the master SSV by pulling and pinning the "Pull to Reset SSV & SDV" knob for each well. Notes: • The pin will drop out when the flowline PSH and PSL sense pressure. • A tie-wrap may be required to hold the pin in until the well is flowing in Step 13.
9.	Open the manual wellhead master valves for each well.
10.	Check the shut-in tubing pressures to determine if the SCSSVs are open or closed.
11.	If the SCSSV(s) are closed, equalize pressure across the downhole valve by pressuring from the surface with a high-pressure water pump.
12.	Open the "wing" SDV valves by opening their actuator air supply valves.
13.	Partially open (i.e., crack open) the inlet manifold header valves to the low-pressure separator. Gas will start flowing to the vent system when the system pressure reaches the set point of the compressor suction vent pressure controller, which is set at approximately 150 psig.
14.	Verify that the glycol contactor is bypassed.
15.	Start the gas compressor (see Sub-Procedure 6.3).
16.	Place the gas lift system in service by taking the following steps: • Open the gas lift casing valves for the gas lift wells. • Open the inlet gas lift header valve. • Align the gas lift manifold valves as required.

Continued on next pag

2. Platform Start-Up Procedure (continued)

Procedure (continued)

Step	Action
17.	For each well in service, slowly open the corresponding manifold header valve to the low-pressure separator.
18.	Reset all flowline velocity checks (at the PSHL sensing point).
19.	Verify that the "Pull to Reset SSV & SDV" relay is still "out" and "unpinned" at the Well Control Panel for each well in service. If the relay is "out" and "unpinned," proceed to step 20. If not, wait for the pressure to increase.
20.	Place the PSHL indicators back in service (take out of bypass) at the Master Wellhead Control Panel.
21	At the Master ESD Panel, place all bypassed shutdowns and alarms that have cleared (green indicator) back in service.
22.	Put the following slave and starter panels in service, and bypass all shutdowns that have not cleared: • Wet/dry oil tank: pull the five "Pull to Reset" relays. • LACT unit: push the two "reset" buttons. • Pipeline Pump Starter Panel: ◆ Push the two reset buttons. ◆ Place one of the two working pumps in the "auto" position. • Pipeline pump panel: pull the "Pull to Reset" relay. • Emulsion treater: ◆ At the starter panel, push the "start" button for the blower. ◆ Pull the "Pull to Reset" relay. (step continued on next page)

Continued on next page

3. Platform Shutdown Procedure

Procedure

Follow these steps to shut the platform down under normal circumstances.

Step	Action
1.	Shut the gas compressor down (see Sub-Procedure 6.3).
2.	Shut the wells in by closing the SSV and the SDV at the Master Wellhead Control Panel.
3.	Close all of the inlet manifold header valves.
4.	Start the diesel generator, and shut down the gas generator.
5.	Shut down the glycol reboiler skid by turning the switch to "off" at the glycol reboiler ignition panel.
6.	Shut down the glycol pumps.
7.	Close the inlet gas lift header valve. If you are leaving the platform, close the gas lift casing valves.
8.	Place the LACT charge pumps and pipeline pumps in the "off" position.
9.	Close the gas and oil pipeline valve.
10.	Turn off the flotation cell pumps.
11.	Close and tag all manual fluid dump valves on the separators, skimmer, treater, and flotation cell.
12.	Bypass the glycol contactor.
13.	Close the manual wellhead master valve if you are leaving the platform.

Note

It is desirable to keep the facilities pressurized when possible after a shutdown, unless the platform will be abandoned. If necessary, isolate and de-pressure the vessels and equipment to the vent system

4. Normal Operations

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6.1 Wellheads

Putting a well in service

Follow these steps to put a well back in service:

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1.</td><td colspan="2">At the Master Wellhead Control Panel, do the following:
Push the “Push to Reset after ESD” knob for the SCSSVs. Hydraulic pump will start.
Wait until the hydraulic pressure is up to 4000 psig and the pump has stopped or is cycling.
Pull the “Pull to Reset after ESD” knob for the SSVs.
Close the air supply to the “wing” SDV actuator for each well.
Bypass all PSHL indicators.
Pull the “Pull to Reset PSHL Indicator Train” knob.</td></tr>
<tr><td>2.</td><td colspan="2">At the Well Control Panel, open the master SSV by pulling and pinning the “Pull to Reset SSV & SDV” knob.</td></tr>
<tr><td>3.</td><td colspan="2">Open the manual wellhead master valve.</td></tr>
<tr><td>4.</td><td colspan="2">Check the shut-in tubing pressures to determine if the SCSSV is open or closed.</td></tr>
<tr><td rowspan="3">5.</td><td>If the SCSSV is...</td><td>Then...</td></tr>
<tr><td>closed,</td><td>equalize pressure across the downhole valve by pressuring from the surface with the high-pressure water pump, and then go to step 6.</td></tr>
<tr><td>open,</td><td>go to step 6.</td></tr>
<tr><td>6.</td><td colspan="2">Open the “wing” SDV valve by opening the air supply valve to the actuator.</td></tr>
</table>

Continued on next page

6.1 Wellheads (continued)

Shut-in

Follow these steps to shut in a well:

Step	Action
1.	Shut the well in by closing the SSV and the SDV at the Master Wellhead Control Panel.
2.	Close the inlet manifold header (test, HP, IP or LP) valve.
3.	Close the manual wellhead master valve.
4.	If it is necessary to depressure the flowlines: • Vent gas through the test header manifold choke valve to the vent scrubber. • If necessary, drain liquids through the sample connection.

6.2 Separators

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6.2 Separators

Re-commissioning

Follow these steps to commission a separator that has been out of service:

Step	Action
1.	Bypass the shutdowns at the Master ESD Panel.
2.	Close the drain valves and the vent valve, if they are open.
3.	Establish level in oil bucket to prevent accidental filling with produced water.
4.	Open the vessel gas outlet valve.
5.	Open the manual block valves that are located immediately upstream and downstream of the oil dump LCV.
6.	Open manual block valves that are located immediately upstream and downstream of the water dump LCV.
7.	Partially open a manifold valve for one well and slowly pressure the vessel to operating pressure.
8.	If the vessel was exposed to the atmosphere, purge through the 1-inch globe valve to the vent header.
9.	After operating pressure and levels are achieved, fully open the manifold valve.
10.	Place all bypassed shutdowns in service as they clear at the Master Panel.
11.	Route any additional wells to the separator via the manifold header valves.

Isolating and depressuring

Follow these steps to isolate and depressure a separator:

Step	Action
1.	Place the shutdowns (PSHL, LSH, LSL) in bypass at the Master ESD Panel.
2.	Divert incoming wells to other separators at the manifold header.

Continued on next page

6.2 Separators (Continued)

Isolating and depressuring

(continued)

Step	Action
3.	Close the following: • The inlet manifold header valves to the separator being taken out of service • The separator gas discharge valve • The manual block valve downstream of the oil dump LCV • The manual block valve downstream of the water dump LCV
4.	To depressure, slowly open the globe valve to the vent scrubber. Close the valve when the separator is completely depressured.
5.	To drain the vessel, open the drain valves to the skim pile. Close the separator valve after the separator has been drained.

6.3 Gas Compressor

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6.3 Gas Compressor

Start-up

Follow these steps to start the gas compressor:

Step	Action
1.	Prelube the compressor by pulling and pinning the "Pull to Run" knob and pulling the "Pull to Prelube" knob.
2.	Wait five minutes.
3.	Check that the oil level indicator for the engine crankcase and compressor has cleared (green indicator). If not, add oil.
4.	Adjust the "Manual Speed Control" knob to 5 psig output to the governor.
5.	Pull the "Pull to Crank" knob to start the engine.
6.	Load the compressor as follows: • Increase the rpm to 820 rpm by using the manual speed controller • Open the discharge valve. • Open the suction valve. • Let the system purge for approximately 60 seconds. • Close the blowdown valve. • Un-pin the "Pull to Run" knob.
7.	Check the "orange" group of indicators; all should be clear (green indicator). If all of these indicators are not clear within 60 seconds, shut the compressor down and fix the problem.

Shutdown

Follow these steps to shut the gas compressor down:

Step	Action
1.	"Pin-out" the "Pull to Run" knob.
2.	Slow the gas compressor to 600 rpm using the manual speed control.
3.	Open the blowdown valve.
4.	Close the suction valve.
5.	Close the discharge valve.

Continued on next page

6.3 Gas Compressor (Continued)

Shutdown

(continued)

Step	Action
6.	Set the “Manual Speed Control” knob to 5 psig output to the governor in order to slow the compressor.
7.	Pull the pin from the “Pull to Run” knob.
8.	Push the “stop” button.

6.4 Glycol Dehydration System

Revision No.	Issue Date	Approval Signature
0	4-12-96	
1		
2		
3		
4		
5		

REVIEWS:

Date Reviewed:	Signature

6.4 Glycol Dehydration System

Start-up

Follow these steps to activate the glycol dehydration system:

Step	Action
1.	Align the process valves for the following: • Flow through the filter separator • Gas flow bypassed around the glycol contractor
2.	Put the slave and starter panels in service, and bypass all shutdowns that have not cleared. At the glycol reconcentrator skid, do the following: • At the ignition panel, push the "start" button for the air blower. • At the slave panel, pull the four "Pull to Reset" relays. • Press the ignitor button to start ignition for the reboiler. • Open SDV-1450 at the Master ESD Panel. • Start one glycol circulation pump. • Reset the velocity check for the pump discharge PSHL sensing point. • When the reboiler temperature reaches 370°F, place the glycol contactor in service.

Shutdown

Follow these steps to shut the platform down under normal circumstances.

Step	Action
1.	Shut down the glycol reboiler skid by turning the switch to "off" at the ignition panel.
2.	Shut down the glycol pumps.
3.	Bypass the glycol contactor.

6.5 Diesel and Gas Generators

Revision No.	Issue Date	Approval Signature
0	4-12-96	
1		
2		
3		
4		
5		

REVIEWS:

Date Reviewed:	Signature

6.5 Diesel and Gas Generators

Diesel generator start-up

Follow these steps to start the diesel generator:

Step	Action
1.	Start the diesel generator: • Use starting air if it is not depleted. • Use the nitrogen bottle if starting air is not available. • Use the 1-4 well's emergency fuel gas if air and nitrogen are unavailable.
2.	Check the diesel fuel level.
3.	Place the indicator switch to the "run" position.
4.	Press the "start" button.
5.	Place the selector switch in the "manual" position.
6.	Close the breaker to energize the distribution bus.

Diesel generator shutdown

Follow these steps to shutdown the diesel generator:

Step	Action
1.	Open breaker to take diesel generator off-line
2.	Place the indicator switch to "idle" and let the generator run for 5 minutes
3.	Place the indicator switch to "off" to stop diesel generator

Gas generator start-up

Follow these steps to start a gas generator after the diesel generator has been placed in service:

Step	Action
1.	Make sure that the diesel generator selector switch is in the "manual" position.
2.	Put the gas generator selector switch in the "manual" position.
3.	Push the "start" button and let the unit warm up for 5 minutes.

Continued on next page

6.5 Diesel and Gas Generators (continued)

Gas generator start-up

(continued)

Step	Action
4.	Turn the synch switch to the "on" position.
5.	Make the Synchroscope's needle move in a clockwise position by adjusting the speed of the generator. When the needle hits the 12 o'clock position, close the breaker to the distribution bus. Note: both the gas and diesel generators are now running in parallel and sharing the load.
6.	Open the breaker on the diesel generator to unload the generator.
7.	Turn the synch switch to the "off" position.
8.	Turn the diesel engine speed down to "idle," let it run for 5 minutes, and then shut the unit down.
9.	Place the off-line gas generator selector switch to "automatic" and place the diesel generator selector switch to "automatic."
Note:	If the on-line generator shuts down, the off-line gas generator will try to start automatically up to three times. If the off-line gas generator does not start, the diesel generator will try to start automatically.

Swapping the gas generators

From time to time, the gas generators will be swapped in and out of service. Follow these steps to start one gas generator when shutting down the other:

Step	Action
Note:	For this example, assume that the No. 1 gas generator is running and the No. 2 gas generator is in standby.
1.	Make sure that the No. 1 gas generator selector switch is in the "manual" position.
2.	Put the No. 2 gas generator selector switch in the "manual" position.
3.	Push "start" button and let the unit warm up for 5 minutes.
4.	Turn the synch switch to the "on" position.

Continued on next page

6.5 Diesel and Gas Generators (continued)

Swapping the gas generators

(continued)

Step	Action
5.	Make the Synchroscope's needle move in a clockwise direction by adjusting the speed of the generator. When the needle hits the 12 o'clock position, close the breaker on the No. 2 unit. Note: both gas generators are now running in parallel and sharing the load.
6.	Open the breaker for the No. 1 generator, removing it from the distribution bus.
7.	Turn the synch switch for the No. 1 generator to the "off" position.
8.	Slow the No. 1 generator engine speed to "idle," let it run for 5 minutes, and then shut the unit down.
9.	Place the No. 1 gas generator selector switch to "automatic" and check that the diesel generator selector switch is also in "automatic."
Note:	If the on-line generator shuts down, the off-line gas generator will try to start automatically up to three times. If the off-line gas generator does not start, the diesel generator will try to start automatically.

Gas generator shutdown

Follow these steps to shut down a gas generator:

Step	Action
1.	Open the breaker to take the gas generator off-line.
2.	Place the indicator switch to "idle" and let the generator run for 5 minutes.
3.	Place the indicator switch to "off" to stop the gas generator.

PROCESS HAZARDS ANALYSIS

MISSISSIPPI CANYON 20-A PLATFORM
TAYLOR ENERGY COMPANY
JANUARY 1996

Prepared by:
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Paragon Project No. 94540

TABLE OF CONTENTS

1. *EXECUTIVE SUMMARY*

A hazards analysis of the Mississippi Canyon Block 20-A (MC 20-A) platform facility was conducted over the period November 13, 1995 to January 19, 1996. The hazards analysis was conducted to comply with the requirements of Taylor Energy Company's Safety and Environmental Management Program. The objectives of the hazards analysis were to identify, evaluate, and mitigate potential hazards of the facility which could result in the release of hydrocarbons, injury to personnel, damage to the environment, or loss of equipment.

The hazards analysis addressed the entire MC 20-A platform. All wellhead and process equipment, the electrical utility system, and the personnel areas were studied. The study evaluated the start up, shut down, and routine operating modes of the facility.

The hazards analysis was based on a checklist methodology to verify compliance with industry codes, standards, and generally accepted engineering practices for the safe design and operation of offshore oil and gas production facilities. As the guidelines of API RP 14J indicate, the checklist methodology is appropriate for this hazards analysis because MC 20-A platform uses only long-proven processes which have well-recognized hazards and associated control methods.

This hazards analysis addressed 981 checklist items and resulted in 75 exception items to the checklist. The hazards analysis team's recommended actions for those exceptions are summarized as follows:

RECOMMENDATION	**NO. OF EXCEPTION ITEMS**
Corrective Action	29 Exceptions
Further Study	26 Exceptions
No Further Action	20 Exceptions

The hazard analysis team's findings and recommendations should be considered preliminary. In all instances, the issues should be evaluated fully by Taylor Energy Company's engineering and operating departments prior to implementing any of the Team's recommendations.

2. *INTRODUCTION*

A Process Hazards Analysis (PHA) of the Mississippi Canyon Block 20-A (MC 20-A) platform was conducted as required by Taylor Energy Company's Safety and Environmental Management Program (SEMP). This initial PHA for the MC 20-A facility was conducted over the period November 13, 1995 to January 19, 1996.

Taylor Energy Company contracted with Paragon Engineering Services, Inc. to provide consulting services for this PHA. A checklist methodology was selected for this PHA. Paragon's PG-HAC checklist program was used to perform this analysis. Potential hazards at the MC 20-A facility were identified and evaluated in this study, and recommended actions were developed to address these potential hazards. This report presents the objectives, scope, methods, and findings of this initial PHA of Taylor Energy's MC 20-A platform.

3. *FACILITY DESCRIPTION*

The MC 20-A Platform is an offshore oil and gas production facility located in the Gulf of Mexico approximately 30 miles southeast of Venice, Louisiana. The platform has two main decks, quarters, and a helideck. The platform operations are continuously manned.

The platform was initially designed to process high-pressure, intermediate-pressure and low-pressure production. The high-pressure system was designed for 60 MMSCFD of natural gas and 10,000 BPD of liquids at an operating pressure of 1,000 psig. The intermediate-pressure system was designed to handle 5 MMSCFD of gas and 10,000 BPD of liquids while operating at 350 to 400 psig. The low-pressure system was designed to process 1.5 MMSCFD of gas and 10,000 BPD of liquids while operating at 140 to 150 psig. In addition, the test separator was designed to process 20 MMSCFD of gas and 1,000 BPD of liquids at an operating pressure of 1,000 psig.

Due to the production decline over the years and the increased amount of produced water, all well stream production now flows through the low-pressure system. The low-pressure separator, intermediate-pressure separator and test separator are operated in parallel at approximately 140 psig. The high-pressure separator was not in service at the time of this study.

Approximately 2.5 MMSCFD of gas is being compressed from 140 psig to 1,000 - 1,200 psig, dehydrated in the glycol contactor, and then routed to the gas lift system or sold to Tennessee Gas Pipeline.

The oil from the separators is sent to the emulsion treater to achieve a Basic Sediment and Water (BS&W) concentration of less than 1%. Due to the high temperature of the oil, the fired component of the emulsion treater is not needed and this component was therefore not in service at the time of this study. From the emulsion treater, the oil is sent to the dry oil tank, then through the Lease Automatic Custody Transfer (LACT) unit for measurement, and finally to the pipeline pumps, which are capable of achieving a discharge pressure of up to 1,380 psig. If off-spec oil is encountered, this oil is sent to the wet tank and then pumped back to the emulsion treater for reprocessing.

All produced water is sent to the skimmer and then to the flotation cell for further treating. The overboard water is routed to the skim pile prior to being discharged into the Gulf of Mexico.

4. *PURPOSE AND OBJECTIVES*

This process hazards analysis was conducted in compliance with Taylor Energy Company's SEMP. The objectives of this study were as follows:

- To identify and evaluate the potential hazards of the facility which could result in the uncontrolled release of process fluids, injury to personnel, damage to the environment, or loss of equipment.
- To determine the qualitative risk level of the identified potential hazards.
- To evaluate compliance with recognized industry codes, standards, and good design practices for the safe design and operation of offshore oil and gas production facilities.
- To reduce the likelihood or minimize the consequences of the identified potential hazards.

5. *SCOPE OF STUDY*

This process hazards analysis addressed the complete MC 20-A facility and all modes of operation. The scope of this study included the following:

- All wellhead, process, and gas lift systems on the MC 20-A facility
- Fuel gas, relief, vent, and drain systems
- Electrical utility system
- Office and quarters buildings
- Start up, shut down, and routine operating modes of the facility

As noted previously, the high-pressure separator and the fired component of the emulsion treater were not in service at the time of the study. These units were, however, evaluated in this analysis.

Several equipment items, such as the pipeline pumps, are identical and operate in parallel or standby service. In these instances, since the equipment design and operating conditions are identical, only one was studied. The evaluation and recommendations reported for a particular equipment item also apply to the parallel identical equipment items.

Piping and Instrumentation Diagrams (P&IDs) and other process safety information used as the basis for this process hazards analysis are listed in Appendix B. A complete list of equipment items studied in this analysis is also included in Appendix B.

6. *APPROACH*

A checklist methodology was used to conduct the Process Hazards Analysis of the MC 20-A platform. The checklist methodology is a hazards analysis technique used to verify compliance with standard practices which have been developed over time to control the hazards identified in a particular process or facility. The checklist methodology was deemed appropriate for this project because only long-proven processes are employed, and these have well-recognized hazards and associated control methods.

The hazards analysis system used for this project, PG-HAC, was developed by Paragon Engineering Services, Inc. PG-HAC is a computer software application which incorporates worksheets and checklists used to perform and document the hazards analysis. Paragon structured the PG-HAC checklists particularly for application to oil and gas production facilities. Using Paragon's PG-HAC system, the platform was reviewed to verify compliance with recognized and generally accepted industry practices of engineering design, installation, and operation.

Paragon engineers conducted the preliminary checklist evaluation using existing process safety information (simplified P&IDs, SAFE charts and electrical area classification drawings), onsite inspection, and interviews with Taylor Energy Company personnel as appropriate.

Paragon engineers completed pre-designed worksheets to document the design parameters and safety systems for each equipment item studied. Then Paragon engineers evaluated all of the checklist questions for each equipment item. If the equipment was found to comply with the checklist question, the question was answered "Yes." If the equipment did not comply or the engineer was not fully satisfied with the item, the question was answered "No." Questions that did not apply to the particular equipment installation were answered "DNA." Lists of the checklists and worksheets used in this study are presented in Appendix B of this report.

Following completion of this preliminary checklist evaluation, a team of Paragon and Taylor Energy employees met to review the findings. The team members were selected based on their qualifications of technical expertise, plant supervisory responsibilities, or working knowledge of the MC 20-A platform.

The following personnel participated in the Hazards Analysis Team review meeting:

Team Leader:

Richard A. Bresler	Lead Process Safety Engineer, Paragon Engineering

Team Members:

Gerald Von Antz	Safety Manager, Taylor Energy Company
Bill Folsom	Operations Manager, Taylor Energy Company
John Posey	Production Foreman, Taylor Energy Company
Larry LaFant	Production Foreman, Taylor Energy Company
Jay Hoyle	Process Safety Manager, Paragon Engineering
John Van Meter	Technology Manager, Paragon Engineering

On January 19, 1996, the Hazards Analysis Team met and reviewed all of the checklist questions that had been answered "No" in Paragon's preliminary evaluation. For each of these exceptions, the team evaluated the potential hazards, the consequences of the failure of the engineering and administrative controls, and the effectiveness of existing safeguards. As part of their analysis, the team also made a qualitative evaluation of the risk of the potential hazards associated with each exception item and recommended actions to address the potential hazards. The Hazards Analysis Team's findings and recommendations for all the checklist exception items are presented in the Action List Report in Appendix A. The Action List Report presents the checklist question, the evaluation of the potential hazard and the risk level, and the recommendation for each of the exception items.

The Qualitative Risk Assessment Matrix that the team used is also presented in Appendix A. The level of risk for any particular potential hazard was determined subjectively, based on the probability of the occurrence and the magnitude of the consequence of a failure to control the potential hazard. The probability of occurrence is defined to be high (1), medium (2), or low (3). The consequence is likewise defined to be high (1), medium (2), or low (3). The resulting qualitative risk level is determined by the intersection of the probability and consequence in the matrix and ranges from high (1) to low (5).

7. *FINDINGS AND RESULTS*

The initial Process Hazards Analysis of the MC 20-A platform was conducted according to a checklist method developed by Paragon for oil and gas production facilities. The potential hazards identified in the analysis are presented in Appendix A to this report along with the recommended courses of action.

The checklist analysis was used to review the MC 20-A platform for compliance with industry recognized safe design and operating practices for offshore oil and gas production facilities. In this analysis, evaluations were made of such matters as engineering controls and safety systems; equipment design in accordance with recognized codes, standards, and generally accepted good practice; appropriate equipment layout; and implementation of safe work practices.

As a part of the analysis, the Hazards Analysis Team made a qualitative evaluation of the risk associated with the potential hazards involved in the exception items to the checklist review. This Process Hazards Analysis addressed 981checklist items and resulted in 75 exception items to the checklist. The remaining items were in compliance with the checklist or did not apply to the MC 20-A facilities. The team's evaluations of the exception items are presented in the Action List Report in Appendix A.

Using the risk level matrix, the number of exception items for each risk level is as shown in the following table:

RISK LEVEL	NO. OF EXCEPTION ITEMS
1 (High)	4 Exceptions
2	5 Exceptions
3	16 Exceptions
4	11 Exceptions
5 (Low)	39 Exceptions

The Hazards Analysis Team recommendations are summarized in the following table:

RECOMMENDATION	NO. OF EXCEPTION ITEMS
Corrective Action	29 Exceptions
Further Study	26 Exceptions
No Further Action	20 Exceptions

The Hazards Analysis Team's findings and recommendations should be considered preliminary. In all instances, the issues should be evaluated fully by Taylor Energy Company's engineering and operating departments prior to implementing any of the team's recommendations.

APPENDIX A

QUALITATIVE RISK LEVEL MATRIX

AND

ACTION LIST REPORT

QUALITATIVE RISK LEVEL MATRIX

Consequence	Probability		
	High (1)	Medium (2)	Low (3)
	Qualitative Risk Levels		
High (1)	1	2	3
Medium (2)	2	3	4
Low (3)	3	4	5

DEFINITION OF PROBABILITY

Probability	Definition
High	Likely to occur several times in life cycle of system
Medium	Likely to occur sometime in life cycle of system
Low	Not likely to occur in life cycle, but possible

DEFINITION OF CONSEQUENCE

Consideration	High Consequence	Medium Consequence	Low Consequence
Illness, Injury	Death or Disabling	Medical Treatment	First Aid
Significant Financial	Corporate	Division/Region	Other
Environmental	Major	Serious	Minor

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: CORRECT

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 02.04 Pressure Vessels Rev Date -- Lead Engineer --- UNASSIGNED
1.	Are the safety devices required by API 14C installed or if not are the SAC exceptions allowed? **** ITEM 1 COMMENTS **** Check if LSL needed.	NO	2	3	4	CORRECT	PRESSURE VESSEL Tag MBF-1810
1.	Are the safety devices required by API 14C installed or if not are the SAC exceptions allowed? **** ITEM 1 COMMENTS **** Check need for LSL.	NO	2	3	4	CORRECT	PRESSURE VESSEL Tag MBF-1820
							Section : 04.01 Hazardous Area Classification Rev Date -- Lead Engineer --- UNASSIGNED
6.	Do purged enclosures have an alarm to indicate loss of purge?	NO	1	1	1	CORRECT	AREA-0001 Tag AREA-0001

**** ITEM 6 COMMENTS ****

The production deck MCC building is barely 10 ft. from the pig launcher. While this is acceptable with API RP500, it makes it imperative that pressurization system be operative with an alarm at loss of pressure or should a door be left open for an extended period of time. The pressurization and air conditioning system is presently under repair. Repairs should include the aforementioned alarms.

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: CORRECT

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 04.01 Hazardous Area Classification Rev Date -- Lead Engineer --- UNASSIGNED
12.	If adequate ventilation or pressurization is used to reduce the area classification or declassify an area, is the source of fresh air outside the classified area?	NO	1	1	1	CORRECT	AREA-0001 Tag AREA-0001

**** ITEM 12 COMMENTS ****

Instrument air compressor is located in a Class I, Div 2 area. While TEFC motor is satisfactory, the intake air should be taken from a source outside of the classified area, preferably from the prevailing wind side of the platform. An alternative is to provide a gas detector at the intake air filter, with 20% LEL to alarm and 60% LEL to shut down.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 04.02 Electric Motor Driver Rev Date -- Lead Engineer --- UNASSIGNED
4.	Is the power disconnect located within sight of and easily accessible to the motor?	NO	3	3	5	CORRECT	PUMP Tag PAX-1110/20/30

**** ITEM 4 COMMENTS ****

The power disconnect is a lockable disconnect breaker on the motor starter located in the production deck MCC room. This room, while located 15 - 20 ft. away, does not give line-of-sight to the motor. The MCC room has no windows and requires doors closed at all times. While this meets NEC requirements, a lockout-tagout procedure should be posted in order to ensure protection of personnel working on motor.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
4.	Is the power disconnect located within sight of and easily accessible to the motor?	NO	3	3	5	CORRECT	PUMP Tag PBA-0910/0920

**** ITEM 4 COMMENTS ****

The power disconnect is a lockable disconnect breaker on the motor starter located in the production deck MCC room. This room doesn't supply a direct line-of-sight to the motor. The MCC room has no windows and requires doors closed @ all times. While this meets NEC requirements, a lockout-tagout procedure should be posted in order to ensure protection of personnel working on motor.

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: CORRECT

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 04.02 Electric Motor Driver Rev Date -- Lead Engineer --- UNASSIGNED
4.	Is the power disconnect located within sight of and easily accessible to the motor?	NO	3	3	5	CORRECT	PUMP Tag PBA-1010/1020

**** ITEM 4 COMMENTS ****

The power disconnect is a lockable disconnect breaker on the motor starter located in the production deck MCC room. This room doesn't supply a direct line-of-sight to the motor. The MCC room has no windows and requires doors closed @ all times. While this meets NEC requirements, a lockout-tagout procedure should be posted in order to ensure protection of personnel working on motor.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
4.	Is the power disconnect located within sight of and easily accessible to the motor?	NO	3	3	5	CORRECT	PUMP Tag PBA-1520/1530

**** ITEM 4 COMMENTS ****

The power disconnect is a lockable disconnect breaker on the motor starter located in the production deck MCC room. This room doesn't supply a direct line-of-sight to the motor. The MCC room has no windows and requires doors closed @ all times. Additionally, there is a firewall between the disconnect breaker and the motor. While this meets NEC requirements, a lockout-tagout procedure should be posted in order to ensure protection of personnel working on motor.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
4.	Is the power disconnect located within sight of and easily accessible to the motor?	NO	3	3	5	CORRECT	PUMP Tag PBA-820

**** ITEM 4 COMMENTS ****

The power disconnect is a lockable disconnect breaker on the motor starter located in the quarters MCC room. This room doesn't supply a direct line-of-sight to the motor. While this meets NEC requirements, a lockout-tagout procedure should be posted in order to ensure protection of personnel working on motor.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
6.	Is the motor frame properly grounded per NEC Article 250?	NO	2	3	4	CORRECT	PUMP Tag PBA-0910/0920

**** ITEM 6 COMMENTS ****

There is a grounding lug missing on the second motor's flexible connector.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
6.	Is the motor frame properly grounded per NEC Article 250?	NO	2	3	4	CORRECT	PUMP Tag PBA-820

**** ITEM 6 COMMENTS ****

A bonding jumper should be installed between the motor frame and structural steel.

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: CORRECT

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 04.02 Electric Motor Driver Rev Date -- Lead Engineer --- UNASSIGNED
10.	Are the operating positions of the control pushbuttons or selector switches clearly marked? **** ITEM 10 COMMENTS **** There is no escutcheon plate, only red and green pushbuttons.	NO	3	3	5	CORRECT	PUMP Tag PBA-1520/1530
13.	Does the motor have a service identification tag?	NO	3	3	5	CORRECT	PUMP Tag PBA-0910/0920
13.	Does the motor have a service identification tag?	NO	3	3	5	CORRECT	PUMP Tag PBA-1010/1020
							Section : 04.03 Light Fixtures Rev Date -- Lead Engineer --- UNASSIGNED
4.	Is fixture properly supported and are the supports free of damage or corrosion? **** ITEM 4 COMMENTS **** Pendant mounted fixtures installed above production deck with stems longer than 4'-0" should have additional bracing.	NO	2	2	3	CORRECT	Tag
9.	Are the illumination levels adequate and in compliance with Illuminating Engineering Society's Lighting Handbook? **** ITEM 9 COMMENTS **** The following fixtures have lamps burned out and should be re-lamped: 1. Stanchion mtd fixture at stair to subcellar deck, SW corner of prod. deck. 2. Pendant mtd fixture @ west side of production deck above gas lift area. 3. Floodlight @ mid-boom of crane.	NO	3	3	5	CORRECT	Tag

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: CORRECT

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 04.05 Generator/Switchgear Rev Date -- Lead Engineer --- UNASSIGNED
22.	Is there a documented lockout-tagout procedure present and in operation?	NO	2	1	2	CORRECT	GENERATOR Tag ZAN-3410
22.	Is there a documented lockout-tagout procedure present and in operation?	NO	2	1	2	CORRECT	GENERATOR Tag ZAN-3420
22.	Is there a documented lockout-tagout procedure present and in operation?	NO	2	1	2	CORRECT	GENERATOR Tag ZAN-3430
							Section : 04.06 Motor Control Center Rev Date -- Lead Engineer --- UNASSIGNED
7.	Are control power transformers properly fused on both primaries and secondaries?	NO	2	2	3	CORRECT	MCC Tag MCC-0001

**** ITEM 7 COMMENTS ****

There were no CPT's located in the starter cans that could be opened. It appears that control power is from an external source. That is acceptable to NEC, but MCC should have nameplate stating that there is an external power source. (NEC Art. 430-74(a), Exception 1b.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
7.	Are control power transformers properly fused on both primaries and secondaries?	NO	2	2	3	CORRECT	MCC Tag MCC-0002

**** ITEM 7 COMMENTS ****

There were no CPT's located in the starter cans that could be opened. It appears that control power is from an external source. That is acceptable to NEC, but MCC should have nameplate stating that there is an external power source. (NEC Art. 430-74(a), Exception 1b.

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: CORRECT

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 04.06 Motor Control Center Rev Date -- Lead Engineer --- UNASSIGNED
15.	Is there is a documented lockout-tagout procedure present and in operation?	NO	2	1	2	CORRECT	MCC Tag MCC-0001
15.	Is there is a documented lockout-tagout procedure present and in operation?	NO	2	1	2	CORRECT	MCC Tag MCC-0002
							Section : 04.09 Transformer Rev Date -- Lead Engineer --- UNASSIGNED
16.	Is adequate unobstructed ventilation space provided around transformer? **** ITEM 16 COMMENTS **** Transformer blocked and used as laydown area.	NO	2	2	3	CORRECT	TRANSFORMER Tag T-3
16.	Is adequate unobstructed ventilation space provided around transformer? **** ITEM 16 COMMENTS **** Transformer blocked and used as laydown area.	NO	2	2	3	CORRECT	TRANSFORMER Tag T-4
							Section : 04.10 Conduit Systems Rev Date -- Lead Engineer --- UNASSIGNED
9.	Are seals provided at the boundary of area classification? **** ITEM 9 COMMENTS **** Seals are present at MCC Building but seals are missing at classified area boundary near emulsion treater and glycol regeneration.	NO	3	2	4	CORRECT	Tag

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: CORRECT

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 04.10 Conduit Systems Rev Date -- Lead Engineer --- UNASSIGNED
							Section : 04.11 Cable Tray Systems Rev Date -- Lead Engineer --- UNASSIGNED
9.	Are cables leaving trays properly supported? **** ITEM 9 COMMENTS **** At rear of Quarters Building, cable support should be improved.	NO	3	3	5	CORRECT	Tag
							Section : 06.01 Control Buildings and Quarters Rev Date -- Lead Engineer --- UNASSIGNED
13.	Is an exhaust hood with a CO2 extinguisher placed over the kitchen range and fryer? **** ITEM 13 COMMENTS **** No extinguisher over range and fryer.	NO	2	2	3	CORRECT	BUILDING Tag BLD-0001
18.	If the building has a special air pressurizing system, can this system maintain a pressure of at least 0.1 inches of water in the quarters with all the openings closed? **** ITEM 18 COMMENTS **** Production deck MCC building has an air conditioning/pressurization system that is currently shut down. The compressor for the system is in the process of repair. System should be repaired as soon as possible because of excessive heating in the building and because of its proximity to hazardous areas. A positive pressure must be maintained at all times.	NO	1	1	1	CORRECT	BUILDING Tag BLD-0001

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: NONE

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 01.01 Equipment and Piping Design Rev Date -- Lead Engineer --- UNASSIGNED
3.	Bleed valve installed between double block valves?	NO	3	3	5	NONE	Tag
							Section : 01.02 Flare and Vent Systems Rev Date -- Lead Engineer --- UNASSIGNED
16.	Are either balanced bellows or pilot operated PSV's used where discharge is to a header and are conventional PSV's used only where discharge is to a tail pipe?	NO	3	3	5	NONE	Tag
							Section : 01.04 Piping and Vessel Material Control Rev Date -- Lead Engineer --- UNASSIGNED
8.	Is 1-1/2 inch or smaller pipe subject to vibration socket welded?	NO	3	3	5	NONE	Tag
10.	Are maintenance drains installed between block valves?	NO	3	3	5	NONE	Tag
							Section : 02.01 Wellhead/Flowline Rev Date -- Lead Engineer --- UNASSIGNED

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: NONE

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 02.01 Wellhead/Flowline Rev Date -- Lead Engineer --- UNASSIGNED
6.	Are insulating gaskets installed where necessary?	NO	3	3	5	NONE	WELLHEAD/FLOWLINE Tag FA2-A1 TO A18
							Section : 02.04 Pressure Vessels Rev Date -- Lead Engineer --- UNASSIGNED
6.	Are shutdown valves provided to limit fuel to a fire on vessels containg over 50 Bbls. of light hydrocarbons?	NO	3	3	5	NONE	PRESSURE VESSEL Tag NBK-0600
8.	If installed, are shutdown valves located as close to the vessel outlet nozzles as practical?	NO	3	3	5	NONE	PRESSURE VESSEL Tag MAF-1400
8.	If installed, are shutdown valves located as close to the vessel outlet nozzles as practical?	NO	3	3	5	NONE	PRESSURE VESSEL Tag MBD-0200
8.	If installed, are shutdown valves located as close to the vessel outlet nozzles as practical?	NO	3	3	5	NONE	PRESSURE VESSEL Tag MBF-1200
8.	If installed, are shutdown valves located as close to the vessel outlet nozzles as practical?	NO	3	3	5	NONE	PRESSURE VESSEL Tag MBF-1450
							Section : 03.05 Centrifugal Pump Rev Date -- Lead Engineer --- UNASSIGNED

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: NONE

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 03.05 Centrifugal Pump Rev Date -- Lead Engineer --- UNASSIGNED
4.	Is a minimum flow recycle bypass installed to prevent pump damage due to low flow and overheating?	NO	3	3	5	NONE	PUMP Tag PBA-1010/1020
4.	Is a minimum flow recycle bypass installed to prevent pump damage due to low flow and overheating? **** ITEM 4 COMMENTS **** Application does not warrant use.	NO	3	3	5	NONE	PUMP Tag PBA-820
							Section : 03.06 Positive Displacement Pump Rev Date -- Lead Engineer --- UNASSIGNED
4.	Are both the pump and driver adequately protected from pressure fluctuations by pulsation devices on the suction and discharge of the pump if required? **** ITEM 4 COMMENTS **** Source vessel is at atmospheric pressure and should provide adequate suction damping.	NO	3	3	5	NONE	PUMP Tag PBA-1520/1530
5.	Are both the pump and driver protected by vibration sensors?	NO	3	3	5	NONE	PUMP Tag PBA-1520/1530
							Section : 04.09 Transformer Rev Date -- Lead Engineer --- UNASSIGNED

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: NONE

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 04.09 Transformer Rev Date -- Lead Engineer --- UNASSIGNED
4.	Are primary and secondary surge arresters provided?	NO	3	3	5	NONE	TRANSFORMER Tag T-1
4.	Are primary and secondary surge arresters provided?	NO	3	3	5	NONE	TRANSFORMER Tag T-2
4.	Are primary and secondary surge arresters provided?	NO	3	3	5	NONE	TRANSFORMER Tag T-3
4.	Are primary and secondary surge arresters provided?	NO	3	3	5	NONE	TRANSFORMER Tag T-4
							Section : 04.10 Conduit Systems Rev Date -- Lead Engineer --- UNASSIGNED
3.	Are conduit runs identified with tag numbers?	NO	3	2	4	NONE	Tag
4.	Are abandoned conduit runs closed and tagged?	NO	3	2	4	NONE	Tag

**** ITEM 4 COMMENTS ****

Conduit runs are not tagged.

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: STUDY

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 01.01 Equipment and Piping Design Rev Date -- Lead Engineer --- UNASSIGNED
2.	Have spec breaks been adequately defined and correctly placed ?	NO	2	2	3	STUDY	Tag

**** ITEM 2 COMMENTS ****

The following need study:
1. Fuel gas from the L.P.Separator and Emulsion Treater (Sheet 118).
2. Low pressure gas from the I.P. Sep. to Comp. Suction (Sheet 105).

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
10.	Does control valve fail in safe position?	NO	1	1	1	STUDY	Tag

**** ITEM 10 COMMENTS ****

Verify if open or closed in the event of valve failure.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
13.	Are procedures for locking or unlocking valves provided?	NO	3	3	5	STUDY	Tag
							Section : 01.02 Flare and Vent Systems Rev Date -- Lead Engineer --- UNASSIGNED
7.	Are flame arrestors located where they can be cleaned?	NO	3	3	5	STUDY	Tag
8.	Is there a secondary path around the flame arrestor in case it gets plugged ?	NO	3	3	5	STUDY	Tag
9.	Are flare lines purged and do they have adequate flashback protection?	NO	3	2	4	STUDY	Tag

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: STUDY

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 01.02 Flare and Vent Systems Rev Date -- Lead Engineer --- UNASSIGNED
26.	Is there a locked valve procedure?	NO	3	3	5	STUDY	Tag

**** ITEM 26 COMMENTS ****
Consider documenting locked valve procedure.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 01.05 Layout Considerations Rev Date -- Lead Engineer --- UNASSIGNED
4.	Are air intakes of fired process equipment, engines, air compressors and HVAC systems located to minimize possibility of contacting flammable gas?	NO	3	1	3	STUDY	Tag

**** ITEM 4 COMMENTS ****
Consider relocating air compressor suction inlet, relocating air comp. skid or installing gas detectors to prevent possible combustible mixture.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
9.	Are hot exhaust surfaces adequately protected from spillage of hydrocarbon liquids from above or venting of hydrocarbon gases from below?	NO	3	3	5	STUDY	Tag

**** ITEM 9 COMMENTS ****
Fire pump engine exhaust is not insulated from potential oil spills/spray and that could result in a fire. Consider insulating exhaust.

Section : 02.04
Pressure Vessels

Rev Date
-- Lead Engineer ---
UNASSIGNED

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: STUDY

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 02.04 Pressure Vessels Rev Date -- Lead Engineer --- UNASSIGNED
2.	Does the SAFE chart indicate all the end devices necessary to shut in flow and shut down equipment as shown on the mechanical flow diagram? **** ITEM 2 COMMENTS **** Consider revising SAFE Chart to show SDV to shut off fuel to compressor driver.	NO	3	3	5	STUDY	PRESSURE VESSEL Tag MAJ-1830
2.	Does the SAFE chart indicate all the end devices necessary to shut in flow and shut down equipment as shown on the mechanical flow diagram? **** ITEM 2 COMMENTS **** Even though H.P.Sep. is currently out of service, consider having PSHL and LSHL shut down ALL wells, not just the affected well, since it is not possible to know which well(s) are flowing to this separator.	NO	2	2	3	STUDY	PRESSURE VESSEL Tag MBD-0300
2.	Does the SAFE chart indicate all the end devices necessary to shut in flow and shut down equipment as shown on the mechanical flow diagram? **** ITEM 2 COMMENTS **** Consider having the PSHL and LSHL shut down ALL wells, not just the affected well, since the shutdown system does not know which well(s) are flowing to this separator.	NO	2	2	3	STUDY	PRESSURE VESSEL Tag MBD-0400
3.	Is the relief valve size adequate for all potential overpressure scenarios including blocked discharge, gas blow-by, fire, and thermal conditions? **** ITEM 3 COMMENTS **** Sized for thermal. Consider installing larger PSV.	NO	2	2	3	STUDY	PRESSURE VESSEL Tag MAF-1400

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: STUDY

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 02.05 Atmospheric Vessels Rev Date -- Lead Engineer --- UNASSIGNED
1.	Are the safety devices required by API 14C installed or if not are the SAC exceptions allowed?	NO	3	2	4	STUDY	ATMOSPHERIC VESSEL Tag BBC-1510

**** ITEM 1 COMMENTS ****

PSV or second vent is missing but required by API 14C.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
2.	Does the SAFE chart indicate all the end devices necessary to shut in flow and shut down equipment as shown on the mechanical flow diagram?	NO	3	1	3	STUDY	ATMOSPHERIC VESSEL Tag BBC-1510

**** ITEM 2 COMMENTS ****

Consider if LSHL and TSH (media) should also interlock to:
-shut off glycol from contactor
-shut off glycol from reboiler
-shut in glycol pumps.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
3.	Is the relief valve size adequate for all potential overpressure scenarios including blocked discharge, gas blow-by, fire, and thermal conditions?	NO	3	1	3	STUDY	ATMOSPHERIC VESSEL Tag ABJ-0900

**** ITEM 3 COMMENTS ****

For the fire case, calculations showed an 8" PVSV is required. Consider increasing the size of the PVSV from 4" to 8" or the equivalent.

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
10.	Have liquid overflow lines been adequately designed to prevent siphoning?	NO	3	2	4	STUDY	ATMOSPHERIC VESSEL Tag ABJ-0900

**** ITEM 10 COMMENTS ****

Confirm overflow line cannot siphon liquids from the tank.

Client : TAYLOR ENERGY
Client Ref : MC BLK 20 FIELD

Project Mgr : RICK BRESLER
Job Desc : HAZARDS ANALYSIS

***** Action Recommendation: STUDY

Item	Question	Answer	Prob	Cons	RISK	Action Required	Study Section Information
							Section : 02.08 Compressor Units Rev Date -- Lead Engineer --- UNASSIGNED
2.	Does the SAFE chart indicate all the end devices necessary to shut in flow and shut down equipment as shown on the mechanical flow diagram? **** ITEM 2 COMMENTS **** Consider relocating PSHL2 between first stage and the cooler. Consider relocating PSHL4 upstream of cooler.	NO	3	3	5	STUDY	COMPRESSOR Tag CAE-1800
							Section : 04.05 Generator/Switchgear Rev Date -- Lead Engineer --- UNASSIGNED
10.	Does generator have protection for overload?	NO	3	3	5	STUDY	GENERATOR Tag ZAN-3410
10.	Does generator have protection for overload?	NO	3	3	5	STUDY	GENERATOR Tag ZAN-3420
10.	Does generator have protection for overload?	NO	3	3	5	STUDY	GENERATOR Tag ZAN-3430
							Section : 04.10 Conduit Systems Rev Date -- Lead Engineer --- UNASSIGNED
12.	Are drains provided in conduit systems per code?	NO	3	3	5	STUDY	Tag

APPENDIX B

BASIS FOR HAZARDS ANALYSIS

LIST OF WORKSHEETS

Taylor Energy Company

Safety Handbook

1996 Edition

This Safety Handbook is presented to

____

By

Taylor
Energy
Company

Date:____________________________

Signature:________________________

Taylor Energy Company

Safety Handbook

Issued to:

____

Date:________________________________

1996 Edition

Table of Contents

Table of Contents(cont.)

1. INTRODUCTION

Taylor Energy Company has high concern for the health and safety of our employees, contractors and visitors doing business with us, and the citizens of the communities where we have an impact. It is our policy to conduct our operations and handle and dispose of all materials in connection with our exploration and production operations safely and without creating unacceptable risks to human health, safety or the environment.

This *Safety Handbook* is designed to help you work safely. If you ever have any questions about material in this handbook or if you are unsure of how to proceed with an operation, *we strongly urge you to talk to your supervisor before beginning the work.* Your safety and that of those around you depends on you. Do not be afraid to ask for help.

2. GENERAL SAFETY RULES

Taylor Energy Company is dedicated to providing safe working conditions for all employees, contract personnel, and visitors. Safety is our number one priority, followed by reliability and efficiency.

Although accidents may not be completely eliminated, injuries ***can*** be prevented. This premise is fundamental to a workable safety program.

Taylor Energy Company's goal is to create a zero-injury environment. To assist in achieving this goal, this handbook was developed to provide formal safety practices and guidelines. However, this handbook alone cannot prevent accidents or replace a common-sense approach to safety. Total commitment by management and a dedicated, involved workforce are indispensable ingredients in an effective safety program.

It is the responsibility of everyone involved to follow the practices outlined in this handbook and to report all accidents, injuries, deficiencies and safety violations. Failure to obey these safety rules can result in serious injury and may lead to disciplinary action, including termination.

All personnel are encouraged to make suggestions, to establish high personal goals for eliminating accidents and injuries, and to participate in informal meetings to discuss the safety aspects of each assignment. If the source of a hazard cannot be eliminated, certain measures can be taken to reduce the danger of the hazard. For instance, special procedures, safety devices or protective equipment and clothing may be used.

Taylor and its employees, contractors, and visitors have the responsibility to comply with all federal, state and local regulations related to safety and health programs. It is hoped that everyone will join in making Taylor Energy Company an industry leader in safety and loss prevention. Please read this handbook carefully and ask questions if the material is unclear; a job is not well performed if it is not understood and performed safely!

2.1 Safety Awareness

Become familiar with the contents of this handbook, and pay particular attention to the sections that apply to your assignments.

A. Confirm that duties are understood and performed in a safe manner by following approved safety practices.

B. Ensure that everyone involved maintains an active interest in the safety program, attends all safety meetings, and becomes familiar with new safety practices and procedures.

C. Informal daily safety meetings are encouraged. These "tail-gate" meetings last about five to ten minutes, and may be as simple as the actions of one employee running through a mental checklist of the safety aspects of his next work assignment. Periodic group meetings are also encouraged. At these meetings, supervisors and other trained employees or third-party specialists can provide in-depth details of new procedures or equipment. It is imperative that everyone give his or her undivided attention in meetings of this type. Taylor's Safety Manager will provide assistance in this area.

D. Observe co-workers' and other people's actions that could cause accidents. Do not be pressured into participating in unsafe work. Do not hesitate to inform any personnel of an unsafe situation.

E. Do not enter an area if there is reasonable doubt about a potential hazard, and no one should perform work on or with equipment that is unsafe.

F. It is up to ***you*** to inform your supervisor of questions about safety practices or suspected safety or health hazards.

2.2 Emergency Procedures

All personnel must be briefed on emergency procedures and escape routes from work locations. The Taylor Foreman is responsible for ensuring that an "Emergency Procedures Notice" has been completed and is posted in the quarters building. Additionally, each individual is required to become familiar with the location of the following:

A. Safety and life support equipment,

B. First aid stations,

C. Safety showers and eye washers,

D. Fire-fighting equipment,

E. Breathing apparatus and other protective equipment for hydrogen sulfide (H_2S) if appropriate,

F. Phones, radios, alarms and detection devices, and

G. Emergency exit devices or means.

2.3 Buddy System

A supervisor should be notified if anyone will be working alone. No one shall be allowed to work alone in a hazardous area or under potentially unsafe conditions. The "buddy system" should be used in all cases in which the situation or working conditions are suspect or the safety rules prohibit working alone.

2.4 Safety Clothing and Equipment

All personnel should select and use the prescribed safety clothing and personal protective equipment for each particular job and should become familiar with the use of respirators if required.

2.5 Lifting and Moving Heavy Objects

Use proper lifting techniques when lifting or moving objects that are within an individual's capability. No attempt should be made to lift or move a heavy object that may cause strained muscles or other bodily damage. Workers should ask for assistance from co-workers or obtain appropriate moving/lifting equipment.

2.6 Housekeeping

The lack of good housekeeping can cause serious accidents and/or bodily injuries. It is the individual's responsibility to keep the work areas clean and to remove and clean tools, equipment and other materials at job completion.

A. Tools or materials should not be left on top of equipment, on scaffolds, on piping, on tanks or in any other places where they may become dislodged and fall.

B. All fuel, water, hydraulic, and air hoses, welding leads and electrical cables should be protected from crushing or cutting.

C. When work is performed in a confined space, all hoses, welding leads, electrical extension cords, etc., should be run through an appropriate opening other than the one used for entry (if possible).

D. Material or equipment must not be positioned in locations that will create stumbling hazards or will block exits, emergency equipment, controls, etc.

E. Spills of oil, mud, water, fuel, hydraulic fluid and chemicals are hazards and should be cleaned up immediately.

2.7 Signs, Tags and Barricades

Obey the intent of all signs and tags. Barricades should not be crossed without proper authorization. A supervisor should be contacted if there are any questions regarding the installation or removal of these items.

2.8 Safety Shutdown Circuits and Lockouts

No one may disconnect, jumper or otherwise disable a safety device or circuit. Prior supervisor approval must be obtained when any device should be placed out of service for testing or maintenance.

A. All safety device malfunctions should be reported immediately, and the affected devices should be tagged. Replacements and other co-workers should be notified of the hazardous condition.

B. All disabled safety devices should be returned to their normal operating positions after testing, maintenance or replacement. Ensure that all associated instrumentation and other safety devices are functional and safe to operate.

C. Lockout devices should not be removed without proper authorization. Work on equipment that requires lockout devices shall not commence until the lockout procedure has been implemented.

2.9 Makeshifts and Temporary Working Aids

Any makeshifts that may compromise safety should not be used. In rare instances when a makeshift is necessary as a temporary measure, supervisory approval is required. Any makeshift shall be replaced or corrected with the appropriate equipment as soon as possible. As an extra precaution, replacements and other co-workers should be notified regarding the makeshift.

2.10 Opening a System From Which Pressure Has Been Bled Off

No one should ever assume that pressure has been completely bled off a closed pressure system. Even a pressure of only a few pounds per square inch can turn a plug, blind flange, valve part, etc., into a dangerous flying projectile. Gauge readings can be incorrect and vent valves can plug; therefore, it is essential that a system never be opened if the system's pressure has not been adequately bled off.

Personnel should always stand aside when unscrewing a plug, gauge, or needle valve so that, if there is pressure on the system, the projectile will miss the face and body. Personnel should never remove the nuts from flange bolts until all the nuts are loosened and the pressure seal is broken and visually checked.

2.11 Trips and Falls

When moving about the work area, personnel should take care to avoid slipping, tripping, stumbling, or falling. Personnel should be especially careful when weather or other conditions may create or aggravate a hazardous situation.

2.12 Working at High Elevations

Personnel should exercise caution when climbing to or working at high elevations. Special precautions are necessary for work at locations without handrails (such as rooftops, tank tops, derricks, etc.). Safety belts must be worn and properly secured at elevations of more than 10 feet above grade or floor level unless adequate protection against falling is provided. Personnel must use safety belts with all ladders that have safety climb mechanisms.

2.13 Radioactive Materials and Radiographic Equipment

In certain areas, usually in the form of scaled-in lines or vessels, naturally occurring radioactive material (NORM) may be present. The radioactivity of these scales is dangerous only if inhaled or ingested.

All personnel should use caution when opening vessels or tubulars and should ***not*** inhale dust from scale materials present. Personnel should remain at a safe distance from radiographic equipment when such equipment is in operation.

2.14 Hydrogen Sulfide (H_2S)

Hydrogen sulfide is an extremely deadly gas. Every worker that can be exposed to H_2S must have a knowledge of the gas, the way to recognize the presence of the gas, and the proper actions to take to avoid exposure. Extreme caution should be exercised when H_2S is known or suspected to be present in a work area. For more details about hydrogen sulfide, see Section 3.7 of this handbook.

2.15 Weather Conditions

Personnel should use appropriate protective clothing and safety equipment when working outdoors in inclement weather. Personnel should not work on the tops of tanks or structures during storms with high winds or lightning.

2.16 Hazardous Working Conditions

All personnel should continuously monitor the work site for hazardous conditions involving equipment, personnel or procedures.

If possible, individuals should correct or eliminate any hazardous conditions. If a hazard cannot be corrected immediately, the individual should attach a sign or marker which will remain until the condition is corrected. The condition should also be reported to the supervisor. In addition, co-workers and personnel coming on duty should be informed of the hazardous condition.

2.17 Reporting of Injuries, Accidents and Deficiencies

All injuries that occur at a Taylor site or while a worker is working on Taylor business ***must*** be reported, regardless of the seriousness, to the Foreman on the date of occurrence. Also report "near miss" situations that could lead to accidents or injuries.

Reporting procedures for contractors, third-party personnel, visitors, or anybody else injured on Taylor's property are the same as those for Taylor employees.

Additionally, incidents of design deficiencies, operating practices, equipment malfunctions/defects, code violations and similar occurrences that can lead to hazards, accidents or injuries should be reported.

Typical examples of incidents that should be reported are:

A. Leaks of flammable or toxic fluids.

B. Leaks of fuel, oil or lubricants on walkways or hot surfaces such as heaters and compressor/engine manifolds and exhausts.

C. Faulty instruments, controls, or gauges.

D. Safety controls or devices that have been removed or bypassed.

E. Expired calibration dates on instruments and relief valves.

F. Chemical spills.

G. Exposed hot surfaces which have damaged or missing insulation.

H. Absence of guards from rotating shafts, motors, couplings, pumps, engines, or hot or cold surfaces.

I. Tools or equipment laying on walkways, stairs, on platforms or on/under ladders in such a fashion that prevents exit or imposes unsafe working conditions.

J. Removal of chains and/or locks from sealed valves or chained-off areas.

K. Faulty or missing fire extinguishers or detection devices.

L. Removal of or the absence of warning signs from hazardous areas.

M. Broken or exposed insulation on electrical wiring.

N. Open or unlocked electrical switchgear.

O. Burned-out or faulty lights and faulty warning devices.

P. Electrical code violation through the use of spark-generating equipment in areas that contain flammable vapors.

Q. Breaks in electrical conduits, omission of seals, corroded terminals, water leaks on non-weatherproof electrical equipment, etc.

R. Faulty, damaged, or missing ladders, grating, stairs, walkways, guards or railings.

S. Openings in decks and floors, or pits that are large enough for a person to fall into.

T. Excessive rust and deterioration of masts, substructures, and other load-bearing structures.

2.18 Preparedness, Attitude and Behavior

Before attempting any job, each individual must become familiar with all safety aspects of the job and any peculiarities associated with the particular equipment or operations. This familiarization is especially necessary when personnel are working on new systems/equipment or nonstandard procedures.

Personnel should not proceed until they are absolutely sure of the appropriate manner in which the task should be done. Personnel should seek advice from their supervisors if there are any doubts.

The job should be approached with a positive attitude, and personnel should not be embarrassed to ask for help or training in regard to the proper way to do a specific job.

Scuffling, practical joking or horseplay of any sort will not be tolerated on the job.

2.19 Mental Awareness and Physical Condition

Many accidents and injuries are due to mental sluggishness and fatigue. Individuals should not push themselves to the limits of mental awareness or physical fatigue. Adequate rest and sleep are essential in order to enhance levels of awareness and health.

A. Personnel safety or the safety of co-workers must not be compromised by the continuance of work during a hazardous or critical operation when the worker becomes fatigued or mentally sluggish.

B. Individuals should pace themselves during double tours and scheduled overtime.

C. Personnel should obtain sufficient rest and sleep before attempting hazardous or critical operations.

D. Preoccupation with non-work-related matters often causes accidents. Personnel should concentrate on the immediate assignment and should not allow emotional influences to compromise safety.

2.20 Alcohol and Drugs

No one will be allowed to attempt to perform work, operate equipment or drive a vehicle or vessel when he or she has used alcohol or has a detectable presence of illegal drugs in their system. The unauthorized introduction, possession, or use of intoxicating beverages, illegal drugs, drug-related paraphernalia, narcotics, firearms, explosives, weapons or other hazardous substances is strictly prohibited on Taylor property or work sites and may lead to termination or arrest.

2.21 Medication

Individuals must immediately inform a supervisor if they are taking prescription medication that may affect their ability to work. Any medical information that may be useful during a medical emergency should also be reported to a supervisor.

2.22 Work Permits

No one will be allowed to perform any work that requires permits or special authorization until appropriate permits and/or documents have been issued. The Taylor Foreman is responsible for issuing and monitoring work permits. Examples are "hot tapping," working with radioactive material, welding, grinding, confined entry, etc.

2.23 Contractors and Visitors

Employees must have a supervisor's approval before admitting a contractor or visitor onto a Taylor facility or site. Those Taylor employees who conduct site tours are responsible for the actions and conduct of the contractors or visitors.

Contractors and visitors must wear proper personal protective equipment for the areas they enter. Visitors must also comply with all other applicable Taylor safety practices.

Contractors must abide by all laws and regulations. Contractors are required to adopt safety procedures and safe work practices equivalent to those of Taylor Energy Company.

2.24 Miscellaneous

A. Smoking is not allowed in designated "non-smoking" areas or near chemicals or rooms containing chemicals, combustibles, flammable liquids or gases.

B. No one should eat near chemicals, radioactive materials or toxic substances.

C. Running is prohibited unless there is an extreme emergency.

D. Gas cylinders and sample bottles shall be used only for their intended purposes.

E. Only approved flashlights will be used, and only low-voltage or safety lights shall be used in vessels or wet locations.

F. All personnel must use proper safety and/or respiratory equipment when handling chemicals and radioactive materials. Respirators are required during the handling of most solvents. Gloves, goggles and aprons are required when caustic chemicals are handled or mixed.

G. Riding on hoists, blocks or crane loads, elevators, or other traveling equipment is strictly prohibited.

H. Caution should be exercised when drains or direct connections to a pressure vessel or line are plugged. Be sure that system pressure has been bled off.

I. Operation of tagged valves without proper approval is prohibited.

J. Pressure must be relieved before hoses are disconnected.

K. Before closing equipment or vessels, inspect them for rags, tools, and other foreign objects, and remove any such objects.

L. Bottles, cans and drums of oil, solvent, caustic, and chemicals must be properly labeled. A supervisor should be notified if any such container's label is missing or illegible. If it is possible that the contents may be toxic or corrosive, a sample should to be taken for analysis in order to guide in the proper disposal of the material.

3. SAFE WORK PRACTICES

3.1 Personal Protective Equipment

A. Head Protection

Safety hats will be worn by all employees wherever head injury hazards exist, or, in the case of offshore work, whenever the employee is outside the living quarters.

Issued hats are selected for their protective qualities. No other types may be worn on the job.

Hair that is long enough to constitute a hazard while working around moving machinery or rotating tools and equipment must be secured by a net or tied back. Hair styles that make it impossible to wear a safety hat properly are not permitted.

Beards that constitute a hazard while working around moving machinery or rotating tools, or when they interfere with the proper fit of any breathing apparatus, are not permitted.

B. Safety Shoes or Boots

All offshore personnel must wear safety shoes or boots (steeltoe).

C. Proper Clothing

Only work clothes that are close-fitting and in good repair will be worn by employees on the job. Clothing will be kept clean by frequent washing to reduce the health and fire hazard of wearing oily clothes. All employees will have a clean change of work clothes available to permit changing out of oil-saturated clothing.

Loose-fitting jewelry, such as necklaces, bracelets, or rings, also pose a hazard around machinery and will not be worn while on the job.

Chemical goggles, protective gloves, and an acid-proof apron are minimum requirements for handling chemicals that may be harmful to the skin or eyes.

D. Eye and Face Protection

Each employee is issued spectacle-type safety glasses to be worn whenever special-purpose eye protection is needed.

Impact-type goggles must be worn when chipping, scraping, buffing, grinding, hammering, or when engaged in any activity involving hazards to the unprotected eye by flying or falling particles or objects.

Complete-coverage eye protection must be worn when dust hazards exist and when any type of pneumatic tool is used.

Splash-proof chemical goggles must be worn in any operation where the eyes may be exposed to hazardous chemicals in either liquid, solid, or vapor form.

Where contact lenses are required for special medical reasons, goggles or spectacle-type safety glasses with side shields must be worn for additional protection.

Wearers of contact lenses must inform their supervisors and/or fellow employees of the fact so that proper emergency treatment can be given if necessary.

Cover glasses must be used with all welding goggles, helmets, and shields.

Suitable eye protection must be worn when inspecting tubing under hydraulic pressure.

E. Hearing Protection

All employees who enter areas where sound levels are 85 dB or greater shall wear adequate hearing protection. Employees who work 12-hour shifts shall wear hearing protection where sound levels are 82 dB or greater.

All are as that require hearing protection shall be marked by a sign stating this requirement at each entry point.

Employees shall be given the option of using hearing protectors that are the most comfortable as long as the attenuation value is not compromised. Contact your Safety Manager to ensure approved hearing protectors are utilized.

(See TEC's "Hearing Conservation Program" in the *Safety Manual*.)

F. Hand Protection

Gloves will be worn whenever practical and while handling rough material or substances, and when the hands are wet from any substance causing a slippery grip.

Rubber gloves must be worn when acids, caustic soda, and soda ash are handled. Rubber gloves are also necessary in certain situations including electrical work.

G. Respiratory Protection

Approved respiratory protective equipment shall be used by personnel who are (or may be) exposed to an oxygen-deficient atmosphere, harmful concentrations of air contaminants or toxic gases.

Workers who may be required to use a respirator shall be clean-shaven where the respirator seals with the face.

H. Safety Belts

Safety belts are required whenever workers are exposed to a possible fall of more than six feet. The safety line shall be of braided plastic-coated cable construction, or of nylon rope and must be properly spliced with snaplink-type fasteners. All safety belts will be kept clean, using only fresh water to prevent corrosion, and inspected regularly for serviceability. If a safety belt is found to be unsafe, it should be destroyed immediately.

(See TEC's "Personal Protective Equipment" practices in the *Safety Manual.)*

3.2 Safety Signs and Color Coding

All employees shall be familiar with and comply with the instructions contained on the various safety signs and color coding present at their locations.

Safety Signs

Danger signs warn that immediate hazards exist and that special precautions are necessary.

Caution signs warn against potential hazards or unsafe practices.

Safety instruction signs remind personnel to emphasize safety.

Color Code:

As a general rule, the color of warning beacon globes shall be:

Red -	Fire or Immediate Danger, High Combustible Gas and H_2S Gas
Yellow -	Low Combustible Gas or Caution
Blue -	Mechanical or Operational Problems (Warning)

Hose colors for use with compressed gases shall be:

Red - Flammable gases
Green - Oxygen
Black - Breathing air
Blue - Inert gases

The colors utilized by your facility must be specified in writing and communicated to all employees if different than those described above.

(See TEC's "Safety Signs and Color Coding" practices in the *Safety Manual.*)

3.3 Blinding and Equipment Isolation

Blinds of sufficient size and strength shall be installed to effectively isolate equipment, vessels, and piping from other parts of operating areas so that repairs, maintenance, or cleaning can be conducted in a safe manner. Closing a block valve will not be sufficient in isolating the area when entering a confined space. Disconnecting may also provide an adequate means of isolation. (See TEC's "Blinding & Equipment Isolation" procedures in the *Safety Manual.*)

3.4 Confined Space Entry

Taylor Energy Company personnel are ***NOT*** authorized to enter any confined space without the advance approval of the Operations Manager. All employees connected with or performing work in a confined space shall be thoroughly trained in the hazards they may encounter, precautionary measures required, and rescue methods needed in an emergency. Examples of confined spaces include but are not limited to: tanks, vessels, sumps, pipelines, vessel skirts, buildings, etc.

(See TEC's "Confined Space Entry" procedures in the *Safety Manual.*)

3.5 Hot Work

A hot work permit must be issued before hot work is performed within 150 feet of an area where combustible or flammable vapors exist or could exist in an "upset" condition. Each permit requires that necessary safety precautions be taken before the work begins and while the work is in progress. The permits are valid only for the job to be done and for a specific length of time or until the end of the shift, whichever comes first.

(See TEC's "Hot Work" procedures in the *Safety Manual*.)

3.6 Lockout/Tagout

When repairing mechanical, pressurized, electrical, or other equipment, personnel must lock out and tag the equipment to warn that it may be dangerous to operate. Personnel must lock and tag all equipment controls (switches, circuit breakers, pumps, blinds, block valves, etc.) and completely de-energize each system being repaired. All equipment shall be in a state of "zero" energy before any maintenance work is started. Each lockout/tagout device shall be removed by the person who applied the device. (See TEC's "Lockout/Tagout" procedures in the *Safety Manual*.)

3.7 Hydrogen Sulfide (H_2S) Safety

No person shall enter an area where H_2S concentrations are known or suspected to be ten (10) parts per million (ppm) by volume in air at the employees' breathing zone without wearing proper supplied air respiratory protective equipment.

All contract personnel working for Taylor Energy Company shall be required to comply with the same H_2S safety requirements as do company personnel.

No tank, line, valve, flange, etc. which may create an H_2S concentration of 10 ppm or greater in the employees' breathing zone shall be opened to the atmosphere ***unless*** proper respiratory protection is worn by personnel performing the job.

A standby person is required when an employee may be exposed to 300 ppm H_2S in the breathing zone during the course of his or her work. The standby person must be equipped with an SCBA.

All H_2S alarms shall be treated as actual gas releases.

(See TEC's "Hydrogen Sulfide Safety Program" in the *Safety Manual*.)

4. FIRST AID

4.1 Introduction

The intent of this section is to present the basic first aid guidelines that must be administered to a victim of an accident or sudden illness until a qualified physician or paramedic can be obtained. *These guidelines are not intended to replace advanced first aid or medical training, but if they are followed, the possibility of death or severe damage to the injured person will be dramatically reduced.*

The following conditions require that basic life support procedures be used immediately:

- Loss of breathing or circulation can cause death or brain damage in four to six minutes.

- Severe bleeding can cause death in one to two minutes.

- Poisoning can cause serious injury or death in seconds, depending on the particular type of poison. Every second counts in preventing further damage.

The primary objective in first aid is to sustain life by utilizing basic life support techniques to:

- Maintain an airway.
- Maintain breathing.
- Maintain circulation.
- Control bleeding.
- Treat for shock.
- Get medical care for the victim.

4.2 Overall First Aid Guidelines

General first aid guidelines are as follows:

- Know the location of the first aid station, life support equipment, emergency showers and eye wash fountains.
- Know the emergency phone numbers for reporting accidents and obtaining ambulances, helicopters and boats.
- Become familiar with the toxic and poison chemicals and gases that are commonly used.
- Inform the supervisor and co-workers if you are sensitive to certain medication such as penicillin, allergic or hypersensitive to insect bites, diabetic, or if you require medication for ailments such as high blood pressure, hypertension, etc.
- Remove clothing contaminated with any chemical or petroleum product.
- Do not attempt to remove foreign material from another person's eye.

- If acid, caustic, toxic or another injurious substance is splashed on the skin or clothing, immediately wash it off with water. Use the emergency shower if required and remove contaminated clothing at once. In some cases, special neutralizing agents are available and should be used as prescribed.

- Use eyewash fountains if acid, caustic, toxic or other injurious substances are splashed into the eyes. If eyewash fountains are not readily accessible, wash with a gentle stream of potable water. Do not use high pressure water.

- Do not panic when providing first aid to an injured person; offer reassurance, inspire confidence, and speak in a soft, gentle voice.

4.3 Specific First Aid Guidelines

A. Loss of Breathing and Circulation

A person whose breathing and circulation have stopped will die or suffer brain damage if these functions are not restored in four to six minutes. The initial evaluation of a victim should follow the procedures developed by the American Red Cross for basic life support, called the "ABC evaluation."

(A) Airway - After assuring yourself that the victim is unconscious, open the airway by tilting the head back. Look into the mouth and remove anything that is blocking or could potentially block the airway. This includes gum, partial plates, and chewing tobacco.

(B) Breathing - Determine whether the victim has stopped breathing or not. Do this by placing the cheek next to the victim's nose and mouth to feel an exchange of air. At the same time, watch for any chest movement.

(C) Circulation - Initially place the tips of two fingers on the larynx (voice box) and slide them gently into the groove between the voice box and the muscle of the neck. This is the location of the carotid artery where you can feel if the heart is circulating blood.

If breathing has ceased, begin mouth-to-mouth or mouth-to-nose resuscitation. If circulation has stopped, begin external cardiac massage. When combined, these procedures are known as cardiopulmonary resuscitation (CPR).

To be performed effectively, the procedures ***must*** be learned in a certified course. Although the procedures will be briefly discussed in this section, the discussion is not intended to replace an official course.

CPR

The following CPR procedure should be performed by a single rescuer after evaluation indicates that breathing and circulation have stopped.

1. Deliver four quick breaths using mouth-to-mouth or mouth-to-nose breathing. Do this in such a way that the victim does not have a chance to completely exhale.

2. Place the heel of one hand over the lower half of the sternum (breastbone) and place the other hand on top of the first hand. Keeping the arms straight, deliver a quick, downward, piston-like thrust to compress the victim's chest 1½ to 2 inches. This procedure compresses the heart between the sternum (breastbone) and the backbone, forcing it to circulate blood. Deliver this thrust 15 times at a rate of approximately 80 times per minute.

3. After 15 compressions, immediately tilt the victim's head back and deliver two quick breaths mouth-to-mouth.

4. Repeat the cycle of delivering 15 compressions and two breaths until medical help arrives.

5. Once a minute, check the carotid artery for a pulse. Do this between compressions and the two breaths.

6. If you feel a pulse, deliver one breath every five seconds while ensuring that circulation is still present. If breathing and circulation return, keep a close watch over the victim in case these processes stop again.

The following CPR procedure is used if a situation involves two rescuers:

1. One person does the ABC evaluation while the other rescuer prepares to deliver external cardiac massage.

2. The rescuer who has done the evaluation and found no breathing or circulation delivers four quick breaths by mouth-to-mouth resuscitation.

3. When the four breaths are completed, the other rescuer starts delivering compressions at the rate of 60 times per minute.

4. After every fifth compression, the first rescuer delivers one breath mouth-to-mouth. The ratio then becomes five compressions to one breath until help arrives or a pulse is restored.

   Never practice CPR procedures on real people. These are violent maneuvers that can injure a person if improperly executed. These procedures are learned in a formal CPR course in which life-size mannequins are used for practice.

Conditions that can cause breathing and/or circulation to stop include: electric shock, inhalation of gas such as H_2S, inhalation of smoke, lack of oxygen, heart attack, drowning, or a hard blow to the chest.

B. Choking

If the victim cannot speak, cough, or breathe, take the following action until medical help arrives:

For a *conscious victim*:

1. Stand just behind and to the side of the victim, who can be standing or sitting. Support the victim with one hand on the chest. The victim's head should be lowered. Deliver four sharp blows between the shoulder blades. If this technique does not lessen choking, go to step 2:

2. Stand behind the victim, who can be standing or sitting. Wrap the arms around the victim's middle, just above the navel. Clasp the hands together in a doubled fist and press in and up in quick thrusts. Repeat this maneuver several times. If choking continues, repeat a cycle of four back blows and four quick thrusts until the victim is no longer choking or becomes unconscious.

For an *unconscious victim*:

1. Place the victim on the ground and deliver rescue breathing. If the victim does not start breathing and if it appears that the air is not going into the victim's lungs, go to step 2:

2. Roll the victim onto one side, facing you, with the chest against the knee. Then, deliver four sharp blows between the shoulder blades. If the victim still does not start breathing, go to step 3:

3. Roll the victim face-up and deliver one or more manual thrusts. To deliver the thrusts, place one hand on top of the other, with the heel of the bottom hand in the middle of the abdomen, slightly above the navel and below the rib cage. Press into the victim's abdomen with a quick upward thrust. Do not press to either side. Repeat this action four times if the victim does not start breathing. Even if breathing begins, go to step 4:

4. Clear the airway.

   Hold the victim's mouth open with one hand, using the thumb to depress the tongue.

   Make a hook with the middle finger of the other hand, and, in a gentle sweeping motion, reach into the victim's throat and feel for a foreign object that may be blocking the air passage. Repeat the following procedure until the air passage is clear; administer four back blows, four abdominal thrusts, probe in the mouth, and try to inflate the lungs.

5. If the object has not been retrieved, but the victim suddenly seems all right, take the victim to the hospital anyway. This action is particularly important if the swallowed object is a fish bone, chicken bone, or another jagged object that could cause internal damage if it passes through the victim's digestive system.

C. Bleeding

Severe bleeding results from wounds to large blood vessels. Bleeding ***must*** be controlled quickly. Don't waste time—apply direct pressure over the wound.

The following procedure should be used in the event of severe bleeding:

1. Place a clean pad, handkerchief, or cloth over the wound and press firmly with the hands. If you do not have a pad or bandage, close the wound with the hand or fingers.

2. Apply pressure directly over the wound.

3. Hold the pad firmly in place with a bandage, necktie, cloth strip, etc.

4. Raise the bleeding part higher than the rest of the body unless bones have been broken.

5. Keep the victim lying down.

6. Keep the victim warm. Cover the victim with blankets or coats, and put something under the victim when the victim is found lying on a cold or damp surface.

7. If the victim is conscious and can swallow, and if abdominal injury is not suspected, provide plenty of liquids (such as water, tea, or coffee).

8. Get medical help.

A tourniquet should be used only to treat severe, life-threatening bleeding that cannot be controlled by other means (usually an amputated, mangled, or crushed arm or leg, or bleeding of several arteries).

The procedure for applying a tourniquet is as follows:

1. Use only a strong, wide piece of cloth. *Never* use wire, rope, twine, or other narrow materials.

2. Place the tourniquet immediately above the wound, between the body and the edge of the wound. Some normal skin should be left between the tourniquet and the wound. If the wound is near a joint, place the tourniquet at the closest practical point above the joint.

3. Make sure the tourniquet is just tight enough to stop the bleeding. If possible, attach a card to the victim showing the time and place the tourniquet was applied.

4. Once the tourniquet has been applied, the victim should be taken to a medical facility immediately. The tourniquet should be removed only by a physician or medical personnel who are prepared to control bleeding.

5. One to two hours is the maximum time that a tourniquet can be left in place without causing further damage.

D. Heart Attack

For heart attack victims, use the following procedure:

1. Perform an ABC evaluation as defined above. Begin CPR if breathing and circulation have ceased. Continue CPR until the vital signs have been restored.

2. If breathing and circulation are present, keep calm and reassure the victim.

3. Loosen the clothing and help the victim get into a comfortable position (usually halfway between lying and sitting). ***Do not*** carry or lift the victim more than necessary. Have someone call for medical help.

4. ***Do not*** give the victim any liquids without a doctor's advice.

Important Telephone Numbers

1. Taylor Energy Company

Corporate Offices	....	(504) 581-5491
Chief Operating Officer		
Hal Bettis	(O).............	(504) 593-8522
	(H).............	(504) 837-4419
	(Pager).........	1-800-426-1605
Operations Manager		
Bill Folsom	(O).............	(504) 593-8450
	(H).............	(504) 837-9956
	(Pager).........	1-800-721-6252
Safety Manager		
Gerald Von Antz	(O).............	(504) 593-8576
	(H).............	(504) 624-8916
	(Pager).........	1-800-426-1610
Aviation		
Jim Bell	(O).............	(504) 242-6033
	(H).............	(504) 866-5863
	(Pager).........	1-800-426-1603
Regulatory Specialist		
Tracy Albert	(O)...............	(504) 593-8510
	(H)...............	(504) 392-1856
	(Pager)..........	(504) 565-2469
Field Foreman		
Central Gulf		
Bruce Williamson	(O)............	(504) 522-8501
	(H)...............	(601) 587-9276
Jim Ray	(O)...............	(504) 522-8501
	(H)...............	(601) 758-3401

Important Telephone Numbers (con't)

Eastern Gulf

John Posey	(O)	(504) 534-9870
	(H)	(334) 602-1027
Larry LaFont	(O)	(504) 534-9870
	(H)	(504) 693-7520

2. Emergency

Poison Control Center	1-800-256-9822
Hospitals, etc.	
N.O. (West Jefferson)	(504) 347-5511
Lafayette General Hospital	(318) 261-7991
Galveston (John Sealy)	(409) 772-1011

3. Governmental Agencies

Minerals Management Service	(504) 736-0557
U.S. Coast Guard	1-800-418-7314

TAYLOR
ENERGY COMPANY

PARAGON
ENGINEERING SERVICES
INCORPORATED

DOE/Taylor SEMP Case Study Technology Transfer Report

Taylor Energy Company

and

Paragon Engineering Services, Inc.

DOE Contract DE-AC22-94PC91008
Subcontract G4S50125

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Contents

1. Introduction

Taylor Energy Company (TEC) in conjunction with Paragon Engineering Services, Inc. (PES) is contracted by the Department of Energy (DOE) to develop, implement and monitor a SEMP on at least five Taylor Outer Continental Shelf (OCS) facilities. This program is being termed a "case study." As part of this contract, Taylor has been charged to conduct an aggressive Technology Transfer program which will share the results of this work as it is completed to help all interest operators develop their own SEMP's.

Reporting is being done by a series of papers which are being presented at industry conferences and seminars as well as examples of finished documents as they have been accepted by BDM, managing contractor for the DOE. This booklet contains copies of the formal presentations conducted to date.

The overall implementation plan is presented in a paper that was presented at the Energy Week Conference in January 1996 (see Section 2). Key to this plan is the development of specific manuals for Taylor's overall SEMP program.

Section 3 includes the Table of Contents of the *Safety and Environmental Management Program Manual.* This manual is considered a "living" document and will be modified as experience with the various elements is gained and experience dictates.

The Tables of Contents (TOC) of three other manuals are provided in this booklet: the *Safety Manual* TOC is in Section 3, the *Safe Drilling and Workover Practices Manual* TOC is in Section 4, and the *Safety Handbook* TOC is in Section 5. The use of these three manuals is described in the implementation plan paper (Section 1).

Section 6 contains a paper presented at the Offshore Technology Conference (OTC) in May 1996 which describes the development of Operating Procedures.

Section 7 contains a paper given at the Society of Petroleum Engineers (SPE) Conference on Health, Safety and Environment in Oil and Gas Exploration and Production, in June 1996, which describes the process used to perform and document Hazards Analysis. It also presents typical examples of items uncovered in the Hazards Analysis process.

Future papers will be made available as additional elements of the SEMP are implemented. If more detailed information is desired concerning the Taylor SEMP case study, please contact Gerald Von Antz at (504) 593-8576 or fax at (504) 593-8591.

PRELIMINARY RESULTS OF A SAFETY AND ENVIRONMENTAL MANAGEMENT PROGRAM (SEMP) CASE STUDY SPONSORED BY THE DOE AND MMS

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ABSTRACT

On June 30, 1994, the MMS published a Federal Register notice requesting that industry voluntarily adopt API RP 75 (SEMP). Under the SEMP program, offshore producers would be responsible for identifying potential hazards in the design, construction and operation of drilling and production rigs and developing specific approaches to reduce the occurrence of accidents.

Many smaller and mid-size independent producers, however, have raised questions over the costs and methods for implementing SEMP. The DOE and MMS determined that a carefully documented case study would answer many of the questions of the smaller producers. With results of the effort oriented specifically to the small- and mid-size companies, independent producers would be much more willing to invest the time and resources to adapt the RP 75 procedures to their own operations.

This paper will discuss the development of a SEMP Implementation Plan, a single model effort that can be transferable, thereby minimizing the expense and duplicative efforts of the producers, which would allow more resources to be devoted to maintaining domestic oil and gas production.

INTRODUCTION

On June 30, 1994, the MMS published a *Federal Register* notice requesting that industry voluntarily adopt API RP 75 (SEMP). Under the SEMP program, offshore producers would be responsible for identifying potential hazards in the design, construction and operat drilling and production rigs and developing s approaches to reduce the occurrence of accidents.

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This paper will discuss the preliminary findings the first six months of the case study, specifica development of a SEMP Implementation Plan a development of Safety and Environmental Informa support of the SEMP.

SEMP IMPLEMENTATION PLAN

The SEMP Implementation Plan is contained in a Manual which was developed to take the words an of API RP 75 and to reduce them into specific stat of what to do to implement the elements.

The essential elements of the SEMP are:

- Safety and Environmental Information
- Hazards Analysis
- Management of Change
- Operating Procedures
- Safe Work Practices
- Training
- Assurance of Quality and Mechanical Integrity of Critical Equipment
- Pre-Start-up Review
- Emergency Response and Control
- Investigation of Incidents
- Audit of Safety and Environmental Management Program Elements

Paragon developed a TEC SEMP Manual which describes a company-wide philosophy to interpret the RP 75 guidelines for each element of SEMP, specifically delineates how each element is to be implemented, and lists responsibilities for documentation and archiving.

Discussed below are some highlights of the company-wide SEMP Manual which was developed for TEC.

Hazards Analysis

A hazards analysis alone does not ensure the facilities are safe; this is only a small part of the overall safety program. Many accidents are the result of, or are attributable to the following: poor operating procedures, deficient management of change procedures, lack of maintenance and testing of safety devices, management pressures to achieve production rates, and so forth.

The first order of business regarding the hazards analysis is to determine the methodology that is appropriate for the facilities being analyzed. Our philosophy is that the majority of production facilities, compressor stations and gas plants employ gravity separation (for gas/liquid separation, oil treating, and water treating), distillation (for LPG recovery), and simple absorption (for gas dehydration and removing acid gases with amine). Typically they are open and not enclosed modules, have zero to fifty persons on-site, and are limited in size. There are no complex chemical reactions which are sensitive to small changes in temperature, pressure, or feedstock. The processes are well known and easy to understand. If the facilities have been designed, built, operated, and maintained in accordance with good practices, uncontrolled releases of hydrocarbons can be successfully avoided.

For these facilities, Paragon and TEC are u computer-based checklist procedure for analysis. This methodology is based on which has been used and continuously mod early 1980s. The analysis contains the foll reviews: general process, process compon system, fire detection and protection, mechanical equipment.

It should be possible to complete the hazar each of TEC's facilities in one to fou depending on the complexity of the f documentation is easy to audit, and co straightforward.

In contrast, a formal HAZOP would take five to ten times the staff time and would experienced engineers. Even with the expended in a formal HAZOP review, it is additional problems of significance would for these facilities.

As required by RP 75, the initial haz performed in an order of priority. This established in accordance with various fact facilities with living quarters, prod simultaneous operations, sour gas, seve conditions (high pressures, highly corrosive and locations near environmentally sensitive

The operating procedures should be comp the start of the hazards analysis. This arra allow the hazards analysis team to review t along with the facilities.

Management of Change

A sound management of change procedure to safe operations. Changes happen almost to improve efficiencies, to improve operabili and sometimes just to keep the facilities r change not carefully thought out can cause or compromise existing safeguards.

The TEC management of change proced three categories of change, each of whic different level of review. The first level is r kind, which does not require a formal ma change review. The second level is a minor A), which requires a review by the lead ope platform foreman. The third level is consid change (Type B), which requires an additio the Engineering Department, the Safety Man

Operations Manager. For both Type A and B changes, a Management of Change Form has been developed.

The manangement of change procedures should be implemented concurrently with the adaption of the SEMP implementation plan.

Operating Procedures

Operating procedures can comprise one of the most effective tools available to improve safety. Various sources have stated that between two-thirds and ninety percent of all accidents are caused by human error. Thus, operating procedures, if properly written and used, should reduce the frequency of accidents and near-misses in the course of daily operations.

We believe that in order for operating procedures to be accepted and used, operating personnel must be involved in the development of the procedures. This involvement encourages these personnel to take ownership of the procedures. Additionally, the procedures must be written in a simple and logical manner that is easy to follow. Complicated, wordy, and lengthy procedures will not be used by operators and therefore will not contribute to safe and environmentally sound facility operation.

The operating procedures for each facility shall address the following: a brief facilities description, start-up, normal operation, temporary operations, emergency shutdown, normal shutdown and isolation, and the course of action that is required by the operator for each process alarm.

Environmental and occupational safety and health considerations can be noted when applicable.

Safe Work Practices

Three manuals comprise management's safe work practices philosophy: The *Safe Operating Practices Manual*, the *Safe Drilling and Workover Practices Manual* and the *Safety Handbook.* Table 1 outlines the tables of contents for each manual.

Safe Operating Practices Manual

In the oil and gas industry, there are many common activities for which generic safe operating practices can be developed. The procedures can be develped within a company or division and used at all sites. *The Safe Operating Practices Manual* is available for reference at each manned location.

It is not practical to expect operators to read remember a lengthy list of procedures. Rathei believe the manual should be organized into an ove: section of General Safety rules, a section of sp Safety Procedures for certain operators, and refe materials regarding API Standards and Basic Firs Facts.

Operating personnel can be expected to read and lea general safety rules. The safety procedures shou written so that each procedure is preferably no more two to three pages in length and the procedures c: used as a texts for safety meetings. More de information contained in API Standards on p operating and maintenance practices is included i manual for reference purposes. API standards exi: Safe Welding and Cutting Practices, Confined S Work, Inspection for Fire Protection, etc. Similar section on basic first aid facts is included for referer assure that first aid information is readily availab every manned facility.

Safe Drilling and Workover Practices Manua

Some oil companies have found that increases in s are possible if the techniques of manage commitment, communication, and training that applied to producing operations are also applie drilling and workover operations.

The generic *Safe Drilling and Workover Pra Manual* is organized using the same philosophy a: used for the generic *Safe Operating Practices Ma* The major difference is that, because of the nature c work, the manual is addressed to the con representative who is in charge of the contract rig. contract company will have its own safety program. purpose of this manual is to provide the con representative with information he needs to revie contractor's safety program for adequacy and to pro backup source of reference material.

Safety Handbook

A pocket-size handbook summarizing important s rules and emergency first aid information is provid employees, visitors, and contract workers. The co of the handbook are essentially the same as those c *Safe Operating Practices Manual,* with a modifications.

Training

Training is an ongoing effort at TEC. The SEMP manual presents an employee training plan that includes the training schedule, describes the method by which the training will be documented, and names the people responsible for implementing and documenting the training. Required subject matter for training is contained in the *Safe Operating Practices Manual* and the Site-Specific Operating Procedures. Table 2 outlines the TEC training topics to be implemented during the course of this project.

Assurance of Quality and Mechanical Integrity of Critical Equipment

This element of SEMP, like hazards analysis, is an ongoing process. There must be a balance between incremental effort and incremental benefits. Therefore, it is important to prioritize the areas that have the greatest impact on safety.

This element addresses procurement, fabrication, installation, maintenance, inspection and testing of new and existing equipment; corrosion; erosion caused by sand production; packings and seals; electrical components; fire fighting systems and equipment; pollution control equipment; and documentation.

Pre-Start-Up Review

A checklist is included in the TEC *SEMP Manual* for review prior to start-up of new and modified facilities. The SEMP Manual describes responsibilities and procedures for assuring that the checklist is implemented prior to start-up.

Emergency Response and Control

TEC already had an oil spill contingency plan, emergency action plan, and hurricane evacuation plan, as should all producers operating in OCS waters. The *SEMP Manual* incorporates these plans by reference and details responsibilities to ensure that the plans are reviewed periodically, that announced and unannounced drills are conducted, and that the results are documented. Some of the drills that will be performed are: abandon platform (monthly for each crew), spill (one announced and one unannounced annually), blowout, explosion, and handling and care of severe injuries.

Investigation of Incidents

TEC already had this element covered in *Manual.* An investigation will be requir incident leading to – or which could reasonab to – a fatality, hospitalization, lost work da treatment, job transfer or termination, consciousness, or a major uncontrolled materials to the environment.

Audit of Safety and Environmental Mana Program Elements

The first audits will be conducted within two y initial implementation of SEMP. The amou between audits should not exceed four years. will review documentation, conduct private in various levels and disciplines of personnel facility inspections.

SAFETY AND ENVIRONMENTAL INFOR

The purpose of this information is to provide t the hazards analysis, operating procedures, a personnel. This section can be one of the mos elements of SEMP if one is starting from "scra challenge is determining what information is how to acquire this information in the most co manner. Remember, at this point, we are not r the facilities. The focus is on obtaining the i that is necessary for the operator to protect environment, and the equipment.

Typically, when a platform is designed, the information is developed (along with many n and kept in job books and drawing books:

- Safety Analysis Flow Diagrams (SAFDs) by MMS
- SAFE Charts - required by MMS
- Process Flow Diagrams (PFDs)
- Detailed Process and Instrument Drawings
- Layout Drawings
- Fire Protection and Safety Equipment Lay
- Electrical Classification Drawings
- Instrument Data Sheets
- Instrument Hookup Details
- Specifications and Vendor Data (On vess equipment, electrical, etc.)

If the original information is still available, it is well worth the effort and much less expensive in the long run to keep the information updated and current. But what if the information is not available, or in other words, what do you do if you are starting from "scratch" as was the case with most of TEC's facilities. The following sections outline what was done and why.

Simplified Process and Instrument Drawings

We determined that, for TEC's existing facilities, a PFD and a detailed P&ID could be consolidated into a simplified P&ID, as long as it provided all the information required for the hazards analysis, operating procedures and training. It can be difficult to define exactly what a simplified P&ID is and exactly what information is required for SEMP. However, a good rule is, that it is better to show too much than not enough.

Should the simplified P&IDs show tag numbers, line numbers, incoming/outgoing process and shutdown signals, package skid limits, valve types, vessel trim (i.e., bridles, bleeds, isolation valves, etc.), and so forth? The answer is: it depends. One has to work backwards from the hazards analysis requirements, operating procedure requirements and items that the client wants shown.

The hazards analysis methodology utilized for this project will incorporate a "modified" checklist. The term "modified" means that the hazards analysis used for an existing facility is less comprehensive than that for a new design. The information that we determined as "essential" and as "optional" on the simplified P&IDs is listed in Table 3.

For operating procedures, the only significant issues were whether or not instrument tag numbers were required and whether or not all manual valves should be shown by one valve symbol, or by different symbols for ball valves, gate valves, globe valves, butterfly valves, etc. We determined that tag numbers would be included on only the safety devices that were tagged on the SAFE Charts. It would be nice to have all the instruments tagged, but it is not essential; therefore, we were not going to invest time tagging all instruments. This situation isn't always the case, because, for many facilities, tag numbers are essential for operating procedures. We did decide to differentiate between various valve types since this job was a rather effortless task if your personnel can easily identify the different valve types.

We choose to leave off alarm and shutdown set points in order to minimize future drawing revisions. These set points are documented on a report that is sent to the MMS monthly and will change frequently as pr conditions change.

Layout Drawings

We combined the information on the Layout dra the Fire Protection and Safety Equipment draw one drawing. In some instances, depending complexity of the facilities, consolidation drawings may not be practical.

Flare and Vent Systems

Flare and vent system information is very ir because in some cases, these systems were designed or modifications were made consideration of the overall design. An isometr is made noting the line size and approximate leng piping runs. This information is used later in the analysis to calculate pressure drops to assure co with API RP 520 and 521. In addition, this infor used for radiation exposure calculations for continuous or instantaneous flow conditions. T difficult information to obtain is the orifice siz relief valve when the data sheets are no longer a It is not practical to remove the relief valves fron to obtain the orifice size in all instances. In t careful assumptions must be made during the based on current conditions. However, sometime the orifice size is not known, the flare and ven analysis cannot be done and must be postponed orifice size can be determined.

Open and Closed Drains

Open and closed drain systems must be carefully. The closed drain system must be ch assure that the valves have the proper pressure The gravity or open drain system is checked be the critical nature of the liquid seal locati elevation differences.

Specifications

If piping specifications are not available, it is that the piping is compatible with the flange rati typically not economical to verify line thickne other piping material information unless there ha history of line failures due to sand production or fluids. Typically, the flow lines and headers up to the production separators are the biggest concern. This issue is further addressed in the mechanical integrity section of the SEMP program.

Vessel and equipment information is often lost and the only available information is on the name-plate. The design pressure and temperature are usually provided, but all other information, such as design capacities, wall thickness, corrosion allowance, etc., are lost. If the equipment has been operating satisfactorily for a significant period of time and adequately sized pressure relief valves are in place, additional information is probably not that important. However, exceptions occur if (1) there is no nameplate or design pressure information or (2) if significant volume increases or changes in operating conditions are expected. In these cases, further action is required to ensure that the equipment is suitable for the intended service.

Electrical Classification

Electrical classification drawings should be developed. Special electrical considerations exist offshore due to the electrical shock probability inherent with steel decks and the marine environment and the space limitations that require equipment to be installed near classified areas.

As a final note regarding process safety information, it is very beneficial for the hazards analysis team leader and the operating procedure coordinator to be inv drawing development. A lot of synergy result same people are involved from start to finish.

CONCLUSION

A SEMP Manual that can easily be adapte companies has been developed and is avai request, as will the other products of this During the first six months of program de Paragon has also compiled process safety inf part of meeting API RP 75's requirements. T date represents the minimum amount of effort to mid-size producer should expect to perfor adequately cover the major areas of hazard operating procedures and training.

Our belief is that by carefully designing a meet the intent of RP 75, a company can gu needless complexity and cost. If such pr developed and conscientiously applied, increa and reduced maintenance, together with less and lower operating costs, can result. Althou of the accident that didn't happen, the employ and deaths that were prevented, or the prope and pollution that did not occur can never be there is no doubt that the cost of implementin program will be repaid may times if even catastrophe is avoided.

Table 1

SAFETY MANUAL

SAFE DRILLING AND WORKOVER PRACTICES MANUAL

SAFETY HANDBOOK

Table 2

Training Program Topics

Presentation of the SEMP Plan	New Employee Orientation
Operating Procedures	Lockout/Tagout
Mechanical Integrity	Hearing Conservation
Safe Work Practices	Medic First Aid
Simultaneous Operations	H_2S Safety
Hazards Communication	Offshore Water Survival
Hazardous Waste Operations and Emergency Response	Bloodborne Pathogens
Crane Operation and Maintenance	Fire Safe Work Permits
Well Control	Basic Firefighting
Environmental Protection and Pollution Control	Personal Protective Equipment
Emergency Response and Control	Respiratory Protection
Contractor Training	Confined Space Entry

Table 3

Essential and Optional Information to be Shown on Simplified P&IDs

Essential P&ID Information	Optional Information
Equipment Tag Number	Bridle Details
Equipment Name	Instrument Tag Numbers
Equipment Size	Line Numbers
Equipment Design Press. & Temp.	Instrument Hookup Details
Equipment Capacity (Flow rates)	Skid Boundaries
Normal Operating Conditions	Specialty Item Callouts
Line Size and Rating	TOL Connections
Reducers	Solenoid Valves
Spec. Breaks	Set Points for Controllers
Valve Types	Shutdown Set Points
Relief Valve Set Points	Alarm Set Points
Instrument Symbols	
Heat Trace	
Insulation	
Instrument Alarms	
Instrument Shutdowns	
CSO/CSC valves	

Safety and Environmental Management Program (SEMP) Manual

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OTC 8112

Operating Procedures - Preliminary Results of a Safety and Environmental Management Program (SEMP) Case Study Sponsored by the DOE and MMS

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bstract

On June 30, 1994, the MMS published a *Federal Register* notice requesting that industry voluntarily adopt API RP 5 (SEMP). Under the SEMP program, offshore roducers would be responsible for identifying potential hazards in the design, construction and operation of rilling and production platforms and developing specific pproaches to reduce the occurrence of accidents.

Many smaller and mid-size independent producers have raised questions over the costs and methods for nplementing SEMP. The DOE and MMS determined hat a carefully documented case study would answer many of the producers' questions. The results of the study vould be oriented specifically to small- and mid-size ompanies, so independent producers would be much more willing to invest the time and resources to adapt the RP 75 procedures to their own operations. As a result, the DOE and MMS have entered into a 30-month study with Taylor Energy Company (TEC) and Paragon Engineering Services (Paragon) to develop a Safety and Environmental Management Plan (SEMP). This program is intended to lemonstrate how small- to mid-size companies can effectively and inexpensively develop a SEMP in accordance with API RP 75.

This paper will discuss the preliminary findings associated with the Taylor Energy Company/DOE SEMP case study. Specifically, the development of operating procedures which meet the intent and spirit of SEM without the traditional high cost typically associated wit "engineered operations manuals" will be discussed.

Introduction

Section 5 of SEMP is titled "Operating Procedures" and written almost identically to the Operating Procedure section in API 750, *Management of Process Hazard* This fact is important to understand because API 750 wa developed for refineries, petrochemical operations, an major onshore processing facilities. API 750 is n directly applicable to most OCS platforms. Since the go of this SEMP project is to develop a "cost-effective method for small and mid-sized independents, this pap will provide thoughts on how to achieve the "spirit" SEMP without incurring the paperwork burdens of complex facility operation.

Overview of Section 5 - SEMP Operating Procedure

Section 5.2.a requires that the written procedures inclu the job title and reporting relationship of the person persons responsible for each of the facility's operati areas.

This goal can be accomplished with a simp organization chart for most small and mid-siz independents. In many cases, such a chart already exis Section 5.2.a offers no pertinent benefit to the sm independent because, in the majority of cases, only o operator (and a helper or roustabout) is responsible for entire platform and perhaps one or more unmann facilities as well. The small independents' organizatio structure is usually very flat, unlike that of a lar organization typically associated with a refinery petrochemical complex.

Section 5.2.b contains instructions for the sound operati of each facility. These instructions involve the main foc and "spirit" of the Operating Procedures. The operating procedures should ensure that operations are executed consistently and safely.

Section 5.2.c pertains to operating limits, consequences of deviation, and steps required to correct or avoid deviation.

Operating limits should already be established because the company should be in compliance with the MMS regulations regarding the periodic testing of safety devices. The various shutdowns (pressure, level, flow, temperature, etc.) are tested and reported on a routine basis. In fact, these shutdown set points establish the operating limits. For independents and most larger operators, this compliance should be satisfactory.

- The steps required to correct or avoid a deviation already exist in the Safety Analysis Function Evaluation Charts (i.e., SAFE Charts) and should have been addressed in the hazards analysis. The accuracy of the SAFE Charts should be verified during the process safety information gathering process. A generic table to list the possible causes of an alarm or shutdown (**Exhibit 1**) if the cause is not easily identified can be included.

- The consequences of deviation are addressed in the hazards analysis, and we believe that, for small operators, this should be satisfactory.

Section 5.2.d covers the following environmental and occupational safety and health considerations:

- Special precautions required to prevent environmental damage and personnel exposure
- Control measures to be taken for physical contact or airborne exposure
- Any special or unique hazards
- Continuous and periodic discharge of hydrocarbon materials
- Special lease stipulations

Much of this information is already addressed in other documents such as Hazards Communications, Oil Spill Contingency Plans, and Simultaneous Operations. This information may be incorporated by reference, if need be.

The only new information that Taylor added was that some hazardous chemicals required a special respirator and gloves for handling. Aside from this exception, Taylor had no other environmental or occupational safety and health considerations to address. However, facilities that have H_2S treating equipment or high acid gas concentrations, for example, would require : handling.

Writing the Operating Procedures

Style/Presentation. First and foremost, op procedures must be user-friendly. Taylors op procedures were written to exhibit the following forr

- Coherent structure
- Modular design
- Straightforward step-by-step instructions

Coherently structured procedures are organized in that "makes sense"; for example, shutdown proc follow start-up procedures, and processes that immediately downstream of the wellhead are ge listed before processes that occur farther downstrea addition, main processes such as separation and oil t are placed before ancillary processes such as instrum supply.

Modular procedures are designed so that indi parts are easily accessible and clearly defined. In ac to making it easy for users to find individual proce modular construction facilitates changing indi procedures, as necessary. To change an indi procedure, simply replace the affected pages, not the document.

From a stylistic standpoint, the best procedures p step-by-step instructions in which each step is (numbered and stated in straightforward languag contrast, any background information is clearly labe such and stated separately in paragraph form. instance, a description of the three-phase sep process should be separate from the step-b instructions for isolating and depressuring a separato

Developing the Procedure: We strongly believe th critical to develop the operating procedures in conju with the platform operator, since no one else is lik know more about how the platform is being op This strategy will prevent writing in a "vacuum creating large amounts of information that will ne used. The most expeditious method is to h technically knowledgeable person, with some op experience, walk through the process with the operat

Writing operating procedures is like any other l skill: it takes practice and it helps to have a good n If a portable PC is available, draft the basic steps procedure while on location for the operator to r prior to departure. Using Paragons Logical Sc Techniques (LST™), the duration of this entire (process was always less than two days for this p most of the seven platforms were completed in one less. With this information, the remaining work can be completed in the office. In addition, taking plenty of pictures during the on-site interview can pay big dividends later.

Office time to complete the first draft of the operating procedures, including the process descriptions, averages forty to sixty hours per platform, depending on the amount and complexity of equipment.

Once the draft version of the operating procedures is written, it should be distributed back to the operators, foremen, and operations manager for comment and discussion. Plenty of time should be allotted for this phase because the operators on each shift shouldn't feel as if the procedures are being imposed upon them. They should feel as they are part of the process.

Sub-Procedures. The main operating procedures should refer to specific sub-procedures for specific equipment items. These specific sub-procedures should be placed in a different section of the operating procedure manual. This practice keeps the main procedures from being to lengthy and unwieldy. For example, should the procedure simply state "start the diesel generator," or, if more details are required, where should the details on "how to start the generator" be located? Before starting the generator, especially after a hurricane, is it necessary to perform a megger check? If the generator windings are wet, starting the generator may cause it to fail. What should be the standard procedure?

In addition, what about switching from the diesel generator to the gas generator? Is it necessary to make sure that the generators are synchronized properly before switching over?

This situation may be a perfect case for an individual generator section. The main action, "start the diesel generator," is listed as step one in the initial start-up sequence, but the sub-procedure is referenced in a separate section for the other details. See **Exhibit 2**, Step 1 for an example.

It may be a good idea to take certain sub-procedures, such as a compressor start-up, and laminate that section and attach it to the compressor panel.

Details. The struggle between keeping the procedures "short" and sacrificing important information or details will be ongoing. For example, an important step to take prior to starting flow is to make sure all the manual valves are in the proper position and that the controllers and control valves are in operation. Does the procedure simply state "Align the process valves for the following equipment..." or does it describe the proper position of each valve on each piece of equipment, or perhaps, is this step something that should be covered during training?

This conflict is a judgment call. Each compan district, or even each facility may decide to hanc situation in a different way. When possible, try 1 "what to do" in the procedure and, if appropria "results" or "cautions" of that action. One shoulc explain "how" to do something in a reference section. The "why" should be explained in traini mechanical integrity activities, and should referei vendor's information. The "how" and "why" ai important if an operator is to work safely. Howeve elements of SEMP are covered in these procedure can quickly grow out of control, and then nobody v them.

Words such as "slowly," "gradually," "soon "quickly" should be discouraged. Human factors tell us operating procedures are one area whe overlook the need for specifics. It is better to be s noting details such as "15 seconds" or "20 psi per m

Graphics. Graphics or diagrams are excellent for l to portray how equipment or processes work and ca the procedures from becoming dreary. Howevei items are also costly. The more complex the facilit more justified diagrams are. To help keep costs refer to the simplified P&IDs, SAFE Charts, etc. 1 already available without incurring additional dra engineering costs required to prepare diagrams.

The Operating Procedure Sections

Process Overview. We believe that a general overview is important. For new people, this overvi summarize the process and it can compleme simplified P&IDs. This overview can also operating options during periods of time when process equipment is out of service; such informati not be obvious from only the P&IDs. At Tayl process description has been kept to a minimum; he others may find it beneficial to expand this sectio **Exhibit 3** for an example.

Start-up. Start-up will normally be the most i section of the procedure. The assumption made ab condition of the platform at start-up is that the facil a "black-out" and "cold" condition, with no gas p and no power. This circumstance is similar to re from a hurricane evacuation in most situations. the main startup procedure as simple as possible, include the details for certain steps, such as start compressor, in a sub-procedure.

Normal Operations. Normally, there is very littl in this section. Most facilities run automatical perhaps only a few manual operating steps to men table indicating normal operating parameters (e.g., pressure, temperature, flow) for the various processes, is typically included; see **Exhibit 4**.

Temporary Operations. For many facilities, there may not be anything to discuss in this section. For more complex facilities, options that would allow certain equipment to be taken out of service without having to shut in the facilities are available. For example, on an oil platform, if the gas compressor is out of service, the platform may be able to vent the associated gas for up to 48 hours and still maintain oil production. This scenario can be explained and the MMS and other agencies can be notified, if required.

Emergency Shutdown. This section is usually very short because most operators simply push the ESD button. Further action to isolate or depressure equipment would normally be covered during training or safety meetings.

Simultaneous Operations. Offshore platforms are often used for multiple or simultaneous operations such as drilling, remedial well work, construction, etc. During simultaneous operations, additional manpower is present and additional demands are placed on the facilities. Special procedures may be required to compensate for these circumstances.

Normal Shutdown. The assumed final condition for shutdown is that all production has ceased and the platform is placed on hot standby.

The normal shutdown of individual processes will often be included in a sub-procedure. Isolation and depressuring can also be covered in the sub-procedure sections.

Authorization

The platform operator, foreman, and operations manager should sign-off on the operating procedures and on any subsequent revisions. This practice is important for standardization and proper management of change compliance.

Periodic Review

It is important to note in the reviews when changes of personnel are made, the management of change procedures apply and new methods of operating must be approved.

Training

Training and operating procedures should be tied closely together. Operating procedures are of little value if they are not communicated to the operators, accepted, and used by them. Once the procedures are written, platform-specific training can proceed. Three areas we considered when developing operating procedure training sessions are: basic operations, platform-specific operatio troubleshooting for the more complex facilities.

Conclusion

Developing operating procedures for a facility can in a concise and cost-effective manner through the the methods discussed in this paper. These metho encourage the operating personnel to think, disc collectively agree as to the safest and most efficient operate the facility.

EXHIBIT 1
EXAMPLE - POSSIBLE CAUSES OF AN ALARM OR SHUTDOWN

'arm/shutdown ›ponse

If an alarm or shutdown occurs, the operator should take action as indicated in the following table:

Condition	Check for...
PSH	• a closed or restricted outlet • a pressure control failure (inlet and outlet) • gas blowby (from upstream component) • changing well conditions • a hydrate plug • thermal expansion
PSL	• a pressure control failure (inlet and outlet) • an open outlet (gas and liquid) • a rupture • a PSE rupture
LSH	• liquid slug flow • blocked or restricted liquid outlet • level control system failure • paraffin blockage
LSL	• level control system failure • an open outlet • a leak (deterioration, erosion, corrosion, damage, vibration)
TSH	• a temperature control system failure • a high inlet temperature • compressor valves • inadequate flow • ignition of a medium leak into fired chamber • an exposed heat transfer surface
BSL	• blower failure • air supply control system failure • blocked air inlet

EXHIBIT 2
EXAMPLE - START-UP PROCEDURE

1. Platform Start-Up Procedure

Start-up

To start-up the platform, complete the following steps:

Step	Action
1.	Start the diesel generator (See sub-procedure E-5 for further details).
2.	Start the air compressor.
3.	Close all manifold header valves.
4.	Align the process valves for the following: • low-pressure separator • fuel gas scrubber • compressor
5.	Place in operation the following: • one of the two flotation cell circulation pumps • the flotation cell's paddle motors • one of the two flotation cell pumps **Note: flotation cell pump will only start when a high oil level is reached.**
6.	At the Master ESD Panel, do the following: • Charge the ESD and fusible loop system: – Pull the "Pull to Charge" knob. – Pull the "Pull to Reset ESD" knob. • Bypass alarms and shutdowns as required (the horn will silence): – Pull the "Pull to Reset - Total Shutdown System" knob and bypass shutdowns a required. – Pull the "Pull to Reset - Test Separator System" knob and bypass shutdowns as required. – Pull the "Pull to Reset - Alarms" knob and bypass shutdowns as required. – Pull the "Pull to Reset - Fuel Gas Scrubber " knob and bypass shutdowns as required.
7.	At the Master Wellhead Control Panel, do the following: • Push the "Push to Reset after ESD" knob for the SCSSVs. The hydraulic pump wil start. • Wait until the hydraulic pressure is up to 4000 psig and the pump has stopped or is cycling. • Pull the "Pull to Reset after ESD" knob for the SSVs. • Close the air supply to the "wing" SDV actuator for each well. • Bypass all PSHL indicators. • Pull the "Pull to Reset PSHL Indicator Train" knob.

EXHIBIT 3
EXAMPLE - PROCESS OVERVIEW

A-3. Oil Handling

Overview

In the oil handling system, liquids from the separators, the glycol system's glycol/condensate skimmer, and the wet/dry oil storage tank are treated to reach a basic sediment and water (BS&W) concentration of less than 1% (design BS&W concentration is 0.5%). The treated oil is then measured and sent to a pipeline.

Equipment

The oil handling system includes the following equipment items, each of which is discussed below:

- emulsion treater
- wet/dry oil storage tank
- wet oil circulating pumps
- Lease Automatic Custody Transfer (LACT) unit
- pipeline pumps

Emulsion treater

The emulsion treater is equipped with two 2 MMBtu/hr 18-inch forced-draft firetubes and an electrostatic precipitator. The treater is designed to process 8,000 BOPD, 1,600 BWPD and 0.3 MMSCFD of gas while operating at 20 to 30 psig.

Some gas flashes off from the oil in the treater's scrubber section. The emulsion then enters a spreader below the firetubes; any free water is removed at this point. Next, the emulsion flows upward around the firetubes and is heated to the required temperature. The emulsion then enters the treater's coalescing section, in which the emulsified water is coalesced (with the aid of the electrostatic precipitator, if necessary) and separated from the oil. Water, gas, and oil are discharged from the treater as follows:

- Water is routed to the water skimmer.
- Gas is routed to the vent system.
- Oil is monitored by a BS&W monitor and routed to the appropriate section of the wet/dry storage tank.

Wet/dry oil storage tank

The wet/dry oil storage tank provides storage capacity for wet oil (greater than 1% BS&W) and dry (pipeline-quality) oil. The tank is a dual-compartment unit with a 1 psig MAWP. Dry oil is routed into the tank's dry section from the emulsion treater. Oil in the dry section is discharged to the LACT unit.

Off-spec oil from the emulsion treater, LACT unit, or water skimmer is routed to the wet section of the wet/dry oil storage tank. From the tank, the off-spec oil is pumped back to the emulsion treater for further treatment.

A natural gas blanket maintains an operating pressure of 5 to 8 inches of water in the tank.

EXHIBIT 4
EXAMPLE - NORMAL OPERATING CONSIDERATION

C-1. Normal Operating Considerations

Monitoring

The normal operation of the production facilities are handled automatically except for the following:

Step	Action
1.	Check the level in the wet side of the Wet/Dry Tank and manually start a recirculat pump to pump the fluids to the emulsion treater as necessary.
2.	Check the oil level in the skim pile and manually start the skim pile pump as necess

Twice a day the operator should check the following:

Step	Action
1.	Verify levels in accordance with the Normal Operating Limits Table (see below).
2.	Inspect for leaks.

Normal operating limits

The following table shows the facilities' normal operating limits.:

The normal operating limit of ...	is...	and is indicated by ...
Production separators	140 psig	various PIs
Compressor discharge pressure	900 - 1200 psig	PI on comp. panel
Comp. interstage pressure	380 - 410 psig	PI on comp. panel
Engine rpm	820 rpm	Tachometer
Fuel gas pressure	40 - 50 psig	PI on fuel gas scrubber
Electrostatic treater pressure	20 - 25 psig	PI
Oil pipeline pressure	10 - 1000 psig	PI on pump discharge
Glycol reboiler temp.	370 - 380 °F	TI
Glycol circulation rate	40 - 50 gpm	FQI on pump discharge
Glycol/condensate skimmer pressure	50 psig	PI
Sock filter diff. pressure	less than 5 psi	PDI
Charcoal filter diff. pressure	less than 5 psi	PDI

SPE 35957

Hazards Analysis: Preliminary Results of a Safety and Environmental Management Program (SEMP) Case Study Sponsored by the DOE and MMS

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This paper was prepared for presentation at the International Conference on Health, Safety & Environment held in New Orleans, Louisiana, 9-12 June 1996.

Abstract

The Minerals Management Service and Department of Energy sponsored a case study project with Taylor Energy Company and Paragon Engineering Services, Inc., to demonstrate how small and medium sized OCS operators might develop and implement a Safety and Environmental Management Program. This paper presents the preliminary results of the Hazards Analysis efforts on this case study project. This paper describes the guidelines for the performance of hazards analyses, the general checklist methodology employed in the analyses, and the performance and results of the analysis of one facility.

Introduction

On June 30, 1994, the Minerals Management Service (MMS) published a *Federal Register* notice requesting that industry voluntarily adopt the American Petroleum Institute (API) *RP75: Recommended Practices for Development of a Safety and Environmental Management Program for Outer Continental Shelf (OCS) Operations and Facilities* (Reference 1). *API RP75* presents recommendations for the identification and management of safety and environmental hazards in design, construction, startup, operation, inspection, and maintenance of drilling and production facilities located in the OCS.

In response to the MMS request, some small and medium sized independent operators have raised questions regarding the efforts and costs required to successfully implement a safety and environmental management program (SEMP). The MMS and Department of Energy (DOE) determined that a case study could demonstrate the development and implementation of a SEMP program. As a result, the MMS and DOE entered into a 30-month study with Taylor Energy Company (Taylor) and Paragon Engineering Services, Inc. (Paragon) to demonstrate how small and medium sized operators could develop and implement a SEMP program.

A paper presented at the 1996 Energy Week Conference describes the plan for organizing and developing Taylor's SEMP program utilizing a SEMP Management Manual, several company-wide manuals (Safety Manual, Safe Drilling and Workover Practices Manual, and Safety Handbook), and site-specific information (Reference 2). A second paper which describes the development of site-specific operating procedures was presented at the 1996 Offshore Technology Conference (Reference 3). This paper describes the efforts and preliminary results related to the hazards analysis elements of this SEMP program.

API RP 75 Guidelines

Recommendations regarding the conduct of hazards analyses are presented in Section 3 of *API RP75*. The recommended purpose of the hazards analysis is to identify, evaluate, and, where unacceptable, reduce the likelihood and/or minimize the consequences of uncontrolled releases and other safety or environmental incidents (Section 3.1). It is recommended in Section 3.2 that the hazards analysis should take an orderly, systematic approach, following one or more methodologies such as are recommended in Section 7 of *API RP14J: Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities* (Reference 4).

Section 3.3 of *API RP75* calls for prioritizing the order in which initial analyses will be conducted on existing facilities. Some of the factors cited for determining the priority are:

- Offshore population
- Inventory and flow rate of potentially hazardous materials
- Presence of simultaneous operations

- Recovery of natural gas liquids or the presence of hydrogen sulfide
- Severe operating conditions such as high pressure, highly corrosive fluids, or abnormal sand production
- Proximity to environmentally sensitive areas.

API RP75 recommends that the hazards analyses be reviewed periodically and updated as appropriate to verify that the most recent hazards analysis reflects the current status of the facility (Section 3.4). Suggested time intervals are five years for high priority facilities and up to ten years for low priority facilities.

The persons performing the hazards analysis should be selected based on their knowledge in engineering, operations, design, process, safety, environmental, and other specialties as appropriate according to Section 3.4 of *API RP 75*. At least one person on the analysis team should be proficient in the methodology being used. Finally, it is recommended that if only one person performs the hazards analysis, that person should not have participated in the original design or the modification the facility.

Section 3.6 presents recommendations regarding the documentation and follow-up of the hazards analysis. A written report should be prepared that describes the hazards identified and recommended actions to mitigate those identified hazards. The identified hazards and recommendations should be communicated to all appropriate personnel. It is recommended that the complete report, including updates, be kept on file for the life of the facility.

Taylor's SEMP Hazards Analysis Program

Taylor's SEMP program requires that hazards analyses be performed for each facility covered by the SEMP. The analyses are to identify, evaluate, and reduce the likelihood or minimize the consequences of uncontrolled releases of process fluids and of other safety or environmental incidents. Taylor's Operations Manager is assigned the responsibility for scheduling, executing, and follow-up of each hazards analysis.

Taylor determined to conduct its hazards analyses using teams of at least two members. The team leader should be knowledgeable in the methodology used. The team should also include at least one member from operations who is familiar with the facility being analyzed. Additional members may be included as necessary for the particular facility (engineering, safety, or environmental specialists, etc.). The Operations Manager determines the members of the team.

Following the recommendations in *API RP14J*, Taylor determined to use a checklist methodology in its hazards analyses to assure compliance with standard industry practices for production facilities in the Gulf of Mexico OCS. Taylor considers the checklist methodology appropriate because its facilities employ only long-proven processes which have well-recognized potential hazards and associated control methods.

The checklist used in Taylor's hazards analyses is the PG-HAC system developed by Paragon Engineering Services, Inc. PG-HAC is a computer software package which incorporates worksheets, checklists, and a qualitative risk matrix to perform and document the hazards analysis. The checklists in PG-HAC are structured particularly for application to oil and gas production facilities.

The hazards analysis team leader is responsible for preparing a report of the hazard analysis. The report presents the potential hazards that were identified, the recommended actions to mitigate the hazards, and a qualitative assessment of the risk level of the identified hazards.

The report is submitted to Taylor's Operations Manager who is responsible for addressing the findings and recommendations in the report. The Operations Manager is responsible for the final resolution of the findings, implementing actions to address the findings, and communicating the resolution to all personnel affected by the actions.

Taylor's SEMP Manual provides that all hazards analyses will be reviewed and updated periodically and includes target dates for the review of each facility. Each review will determine whether the most recent hazards analysis reflects the facility's current status.

The report of each hazards analysis that is performed on each facility is kept on file at Taylor's New Orleans office for the life of the facility. The report will be maintained for use in the periodic reviews as discussed above.

PG-HAC Description

PG-HAC is a generic hazards analysis checklist program that was developed specifically for oil and gas production facilities. The system guides the execution of the analysis and produces the documentation of the study. It is organized into a series of reviews that include worksheets and checklists. The major review sections are the general process review, the process component review, the mechanical equipment review, the electrical system review, the fire/gas/smoke protection review, and the control buildings and quarters review. A complete listing of the checklist reviews is shown in Table 1.

The system is designed so that the hazards analysis is conducted in two stages, a preliminary evaluation stage and a team review stage. This promotes the efficient use of manpower by limiting the team's time to only the issues that need corrective or follow-up action.

In the preliminary evaluation, engineers complete pre-designed worksheets to analyze and document such matters as design parameters, operating conditions, and safety system configuration. Then the engineers evaluate all of the checklist questions for each equipment item or system. The checklist questions are structured to be answered "yes," "no," or "not applicable." If the equipment was found to comply with the checklist question, the question was answered "yes." If the equipment did not comply or the engineer was not fully satisfied with the item, the question was answered "no." Questions that did not apply to the particular equipment installation were answered "not applicable." An example worksheet and checklist are presented in Figure 1 and Figure 2 respectively.

The PG-HAC system also includes a qualitative evaluation of the risk level of each identified potential hazard. This evaluation uses a three by three Qualitative Risk Assessment Matrix which is shown in Figure 3. The level of risk for any particular potential hazard is determined subjectively, based on the probability of the occurrence and the magnitude of the consequence of a failure to control the potential hazard. Both the probability of occurrence and the consequence are defined in three levels, high, medium, or low. The resulting qualitative risk level is determined by the intersection of the probability and consequence in the matrix and ranges from high (1) to low (5).

After the engineers complete the preliminary review, the hazards analysis team meets to review the checklist questions. Since a "yes" answer indicates that the facility is in compliance with the particular standard practice issue, the team does not need to analyze questions answered "yes" any further. Thus, the team only reviewed and analyzed those checklist questions which had been answered "no" in the preliminary evaluation. The team makes a determination of the qualitative risk of each issue and recommends action to address the issue. These team conclusions are incorporated into the checklists for the final documentation and report.

Conducting the Hazards Analysis

The hazards analysis was conducted in two stages, the preliminary evaluation stage and the team analysis stage.

In the preliminary stage, Paragon's engineers completed the PG-HAC worksheets and checklists using the safety and environmental information (simplified P&IDs, SAFE Charts, Electrical Area Classification Drawings, etc.) which had been prepared in accordance with Taylor's SEMP program, as described in Reference 2. A hazards analysis should be based on the current facility configuration and documentation. Where facilities have been in service for some years or have had multiple operators, detailed engineering drawings and data that are complete and current are frequently difficult to obtain or simply not available. As a prior task of this Taylor SEMP case study, Paragon's engineers and designers used Taylor's existing safety and environmental information and onsite inspections to prepare updated drawings and safety documentation as specified in Taylor's SEMP program. This current, revised documentation, coupled with onsite inspections by facility and electrical engineers, was sufficient to complete the PG-HAC worksheets and checklists.

The hazards analysis team then met to analyze the findings of the preliminary evaluation for each platform. This team typically included the Operations Manager, Safety Manager, Operations Field Foremen, and facilities, process, and electrical engineers and was led by one of Paragon's process safety engineers.

The preliminary findings were then revised to reflect the conclusions and recommendations of the hazards analysis team. The report of the hazards analysis was submitted to Taylor's Operations Manager for resolution and follow-up.

Results of Hazards Analysis of an Example Platform

The facility was originally installed in 1987 and is located in about 480 feet of water. Taylor acquired the facility in 1995. The facility processes gas, oil, and water. It includes living quarters and is continually manned by Taylor employees. The facility is operated with two men per shift. This process hazards analysis addressed the complete facility and the various modes of operation. The scope of this study included the following:

- All wellhead, process, and gas lift systems on the facility
- Fuel gas, relief, vent, and drain systems
- Electric utility system
- Office and quarters buildings
- Start up, shut down, and routine operating modes of the facility

A total of 88 equipment items were covered in the analysis. Piping and Instrumentation Diagrams (P&IDs) and other process safety information used as the basis for this process hazards analysis are listed in Table 2.

Following completion of the preliminary checklist evaluation, the hazards analysis team met to review the findings. For each checklist question that had been answered "no" in the preliminary evaluation, the team evaluated the potential hazards, the consequences of the failure of the engineering and administrative controls, and the effectiveness of existing safeguards. As part of their analysis, the team also made a qualitative evaluation of the risk of the potential hazards associated with each exception item and recommended actions to address the potential hazards. The hazards analysis team's findings and recommendations for all the checklist exception items are presented in the Action List Report which is included as an appendix to the hazards analysis report. The Action List Report presents the checklist question, the evaluation of the potential hazard and the risk level, and the recommendation for each of the exception items.

This hazards analysis addressed 981 checklist items and resulted in 75 exception items to the checklist. The remaining items were in compliance with the checklist or did not apply to this facility. Of the 75 exception items, the hazards analysis team concluded that the risks associated with 20 of the items were sufficiently low and recommended no further action be taken. The team recommended further study of 26 exception items and corrective action for 29 of the exception items. Some typical issues recommended for study or correction include:

- Piping design spec break problems
- Safety shutdown logic revisions

- Pressure vacuum safety valve size not large enough to handle fire exposure condition
- Improved documentation and posting of locked valve procedures and lockout/tagout procedures
- Air compressor intake located in classified area
- Clear markings missing from some motors and motor control switches
- Seals missing from conduit systems

The hazards analysis took about three man-days for the field inspection, eight man-weeks to prepare the preliminary checklist evaluation, one day for the team review meeting, and one man-week to prepare the report and finalize the documentation. The cost for non-Taylor personnel was about $23,000 and for Taylor personnel was minimal.

Conclusions

This case study has demonstrated that a generic hazards analysis checklist can produce a thorough, cost efficient study of a typical OCS oil and gas production facility. A detailed checklist is required to assure adequate coverage for manned production facilities. By applying pre-determined detailed checklists to each equipment item and to the piping systems, vent and drain systems, layout and buildings, and the electrical systems, results can be obtained that are as effective as HAZOP methods for these types of facilities but significantly less time consuming. The staged approach used in this project provides a method that minimizes the time of operations personnel to only the amount of time necessary to address the identified potential hazards. This can be especially important to operating companies, particularly small and medium sized operators, as they try to manage operations with lean organizations.

The cost of a hazards analysis of an OCS production facility may seem difficult to justify on the basis of the problems uncovered for this type of operation. However, this study indicates that it is common to find that modifications have been made over the years and changes in operating conditions have occurred that undermine the safe performance of the original design and installation. A thorough hazards analysis can also reveal errors that were made in the original design work or instances where industry practices have advanced to enhance safe operations. Therefore, it seems that there is real value in conducting a cost-effective hazards analysis on this type of existing facility.

References

1. American Petroleum Institute: RP75 Recommended Practices for Development of a Safety and Environmental Management Program for Outer Continental Shelf (OCS) Operations and Facilities, first edition, American Petroleum Institute, Washington, DC, May 15, 1993.

2. Bresler, R.A. and Von Antz, G.: "Preliminary Results of a Safety and Environmental Management Program (SEMP) Case Study Sponsored by the DOE and MMS," paper presented at the 1996 Energy Week Conference and Exhibition, Houston, Jan. 29-Feb. 2.
3. Bresler, R.A. and Von Antz, G.: "Operating Procedures - Preliminary Results of a Safety and Environmental Management Program (SEMP) Case Study Sponsored by the DOE and MMS," paper OTC 8112 presented at the 1996 Offshore Technology Conference, Houston, May 6 - 9.
4. American Petroleum Institute: RP14J Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities, first edition, American Petroleum Institute, Washington DC, September 1, 1993, 46.

Table 1. List of Checklists

General Process Review
Equipment and Piping Design
Flare and Vent Systems
Drain Systems
Piping and Vessel Material Control
Layout Considerations

Process Component Review
Wellhead / Flowline
Wellhead Injection Lines
Headers
Pressure Vessels
Atmospheric Vessels
Fired and Exhaust Heated Components
Pumps
Compressors
Pipelines
Pig Launchers and Receivers
Heat Exchangers

Mechanical Equipment Review
Reciprocating Compressors
Centrifugal Compressors
Centrifugal Pumps
Positive Displacement Pumps
Turbine Drivers
Diesel / Natural Engine Gas Driver

Electrical Systems Review
Hazardous Area Classification
Electric Motors
Light Fixtures
Junction Boxes
Generators/Switchgear
Motor Control Center
Cables
Grounding
Transformers
Conduit Systems
Cable Tray Systems

Fire/Gas/Smoke Protection Review
Fire/Gas/Smoke Detection and Protection

Control Buildings and Quarters Review
Control Buildings and Quarters

Table 2. Basis for Hazards Analysis

PROCESS CONDITIONS		
Inlet Flow Rates		2.4 MMSCFD Gas, 1,200 BPD Oil, 6,000 BPD Water
Operating Pressure		140 psig inlet, up to 1380 psig oil pipeline, up to 1200 psig gas pipeline
PROCESS SAFETY INFORMATION		
Simplified P&IDs		
94540-S-01-100	Rev. 0	Wells and Manifold
94540-S-01-101	Rev. 0	Lift Gas Manifold
94540-S-01-102	Rev. 0	Test Separator
94540-S-01-103	Rev. 0	High Pressure Separator
94540-S-01-104	Rev. 0	Intermediate Pressure Separator
94540-S-01-105	Rev. 0	Low Pressure Separator
94540-S-01-106	Rev. 0	Emulsion Treater
94540-S-01-107	Rev. 0	Skimmer
94540-S-01-108	Rev. 0	Flotation Cell
94540-S-01-109	Rev. 0	Skim Pile
94540-S-01-110	Rev. 0	Wet/Dry Oil Tank and LACT Unit
94540-S-01-111	Rev. 0	Pipeline Pumps, Pig Launcher and Departing Oil Pipeline
94540-S-01-112	Rev. 0	Compressor and Fuel Gas Filter
94540-S-01-113	Rev. 0	Filter Separator
94540-S-01-114	Rev. 0	Gas/Glycol Contractor, Heat Exchanger, and Scrubber
94540-S-01-115	Rev. 0	Glycol Reconcentration Skid
94540-S-01-116	Rev. 0	Sales Gas Meter Skid, Pig Launcher, Departing Gas Pipeline
94540-S-01-117	Rev. 0	Fuel Gas Scrubber and Fuel Gas Generator Pumps
94540-S-01-118	Rev. 0	Vent Scrubber and Vent Boom
Life Saving and Emergency Equipment Location		
94540-S-01-119	Rev.0	Life Saving and Emergency Equipment Location
Electrical Area Classification Drawing		
94540-S-01-120		Electrical Area Classification Drawing
SAFE Charts		
Sheets 1 thru 18	2/10/95	Safety Analysis Function Evaluation Chart

Figure 1. Example Worksheet

PROCESS COMPONENT REVIEW -PRESSURE VESSEL

SEPARATOR - Tag Number MBD-0000

Client :CLIENT NAME
Client Ref :FACILITY NAME
Job Desc :NOT ENTERED

Project Manager : NOT ENTERED
Study Section : 02.04
Section Lead Engr : NOT ENTERED
Section Status : Rev Dated

I. Design Data

Drawing Number : NOT ENTERED

Design Pressure : ______.__ PSIG	Operating Pressure : ______.__ PSIG	
Design Temperature: ______.__ DEG F	Operating Temperature: ______.__ DEG F	

	------ Oil -----	---- Water -----	----- Gas ------
Flow Rate	______.__ BPD	______.__ BPD	______.__ MMSCFD
Specific Gravity	__.__	__.__	__.__

II-A. Safety System - Safety Devices

Item	API RP 14C Device	On MFD?	"SAC" Exception	Exception Allowed?	Explain
1.	PSH				
2.	PSL				
3.	PSV				
4.	LSH				
5.	LSL				
6.	FSV				
7.	TSH				

II-B. Safety System - End Devices Necessary to Shutin Flow

Item	From MFD's	From Safe Chart	Comments
1.			
2.			
3.			
4.			
5.			

III. Relief Valve Check

	From MFD'S				From Spec Sheets			
	---- Primary		------ Secondary ----		--- Primary		-------- Secondary ---	
	Pressure	Units	Pressure	Units	Pressure	Units	Pressure	Units
Rating	______.__	PSIG	______.__	PSIG	______.__	PSIG	______.__	PSIG
Set	______.__	PSIG	______.__	PSIG	______.__	PSIG	______.__	PSIG

FLOW CONDITIONS

DESIGN FLOW CRITERIA	Liquid Rates		Gas Rates		Calc. Size
	---- BPD --	S.G.-	- MMSCFD --	S.G.-	---------------
Blocked Discharge	______.__	__.__	______.__	__.__	______________
Fire	______.__	__.__	______.__	__.__	______________
Blowby Upstream Vessel	______.__	__.__	______.__	__.__	______________
Blowby Through Drain	______.__	__.__	______.__	__.__	______________

Figure 2. Example Checklist

Checklist 02.04

Pressure Vessels

SEPARATOR - Checklist 02.04, Job 95419-I Report

Client	: CLIENT NAME	Project Manager	: NOT ENTERED
Client Ref	: FACILITY NAME	Section Lead Engr	: UNASSIGNED
Job Desc	: NOT ENTERED	Section Status	: Rev Dated

Item	Question	Answer	Prob	Cons	RISK	Action Required	Responsible for Action
1.	Are the safety devices required by API 14C installed or if not are the SAC exceptions allowed?	___	_	_	_	________	________
2.	Does the SAFE chart indicate all the end devices necessary to shut in flow and shut down equipment as shown on the mechanical flow diagram?	___	_	_	_	________	________
3.	Is the relief valve size adequate for all potential overpressure scenarios including blocked discharge, gas blow-by, fire, and thermal conditions?	___	_	_	_	________	________
4.	Do all gauge glasses have shut-off valves with safety check valves?	___	_	_	_	________	________
5.	Are all gauge glasses either reflex, transparent, or steel-armored type?	___	_	_	_	________	________

FIGURE 3. Qualitative Risk Level Matrix

	Probability		
	High (1)	Medium (2)	Low (3)
Consequence	**Qualitative Risk Levels**		
High (1)	1	2	3
Medium (2)	2	3	4
Low (3)	3	4	5

DEFINITION OF PROBABILITY

Probability	**Definition**
High	Likely to occur several times in life cycle of system
Medium	Likely to occur sometime in life cycle of system
Low	Not likely to occur in life cycle, but possible

DEFINITION OF CONSEQUENCE

Consideration	**High Consequence**	**Medium Consequence**	**Low Consequence**
Illness, Injury	Death or Disabling	Medical Treatment	First Aid
Significant Financial	Corporate	Division/Region	Other
Environmental	Major	Serious	Minor